FOR
BETTER MANAGEMENT
OF
PLANT OPERATIONS

FACTORY

february 1960

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A McGRAW-HILL PUBLICATION

MAINTENANCE BEHIND THE IRON CURTAIN
p. 62

WHO SAYS PRODUCT COMMITTEES DON'T PAY OFF
p. 71

DON'T LET YOUR PLANT GO UP IN SMOKE
p. 162

Managers (inset) plan emergency action at IBM cover plant.

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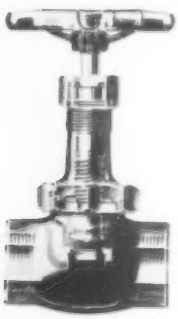

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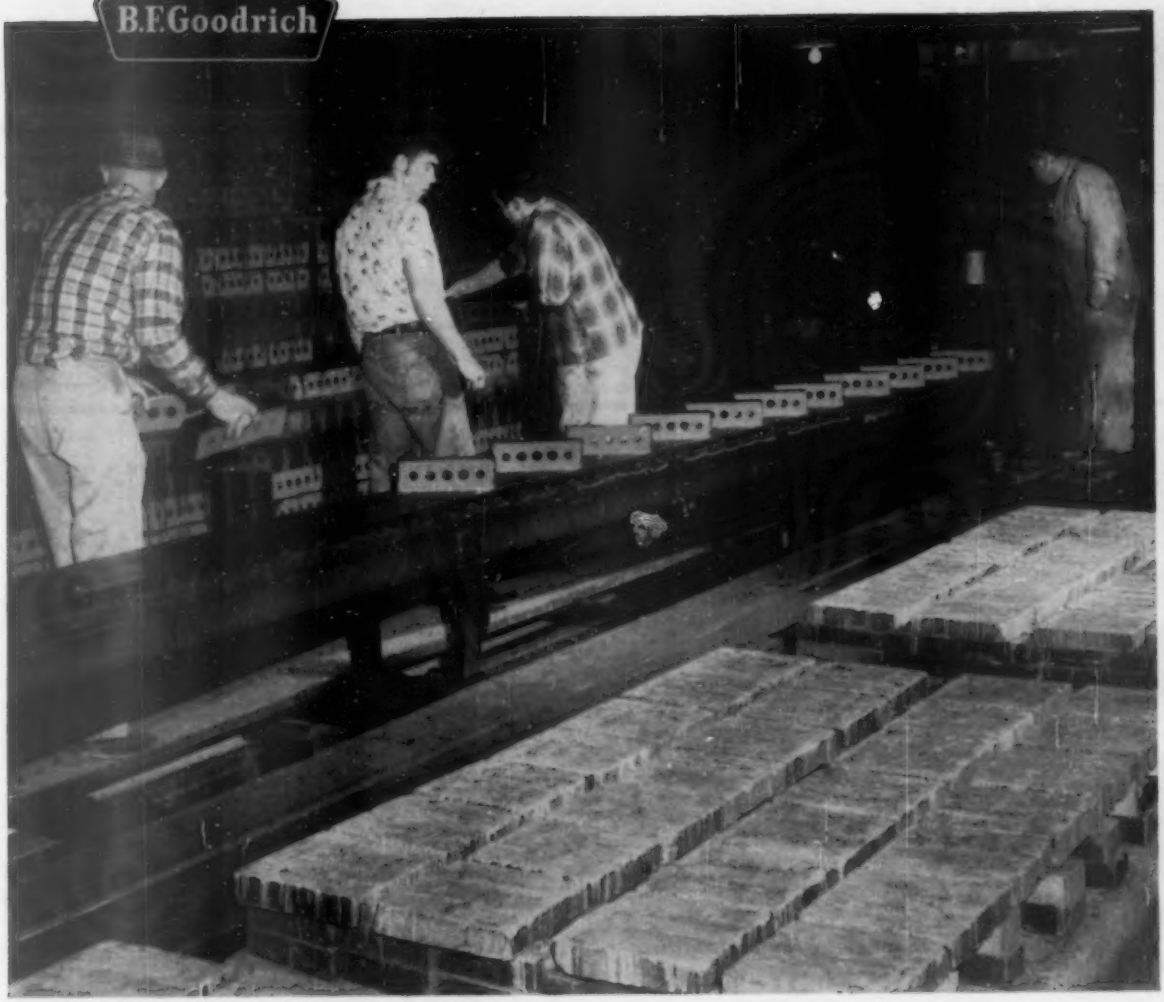

Oily bricks ride on Koroseal

THAT conveyor belt collects soft bricks from a cutting machine and brings them to the inspection area. The perfect bricks are then stacked for firing in a kiln, the rejects go back for reshaping. But finding a belt that could keep this production line moving was a problem. The bricks are heavily coated with diesel oil. This plus abrasive brick dust plus moisture ruined ordinary belts almost at once.

Various kinds of canvas and rubber belts were tried. But the oil would soak into the belt, blister the rubber, rot the fabric. When a B.F.Goodrich distributor heard of the problem, he suggested a belt made of Koroseal flexible material.

This B.F.Goodrich belt defies the stuff that ruins other belts—oil, grease, chemicals, most acids, alkalies. The Koroseal cover is tough, resists abrasion, cracking, peeling, never gets soft or sticky.

At last report the B.F.Goodrich Koroseal belt had been in service seven months (longer than any belt used previously), and showed no sign of wear or deterioration. In the meantime, the Koroseal belt has helped the plant step up production to an average of 38,000 bricks a day, made substantial savings in maintenance and labor costs.

Your B.F.Goodrich distributor has the exact specifications for the Koroseal belt described here. And as a factory-trained specialist in rubber products, he can answer your questions about the many products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Company, Department M-784, Akron 18, Ohio.*

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FEBRUARY 1960

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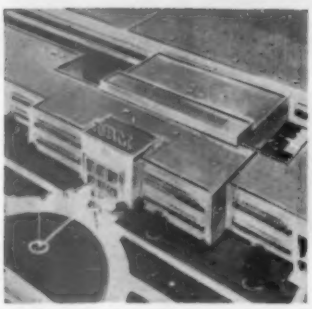

THE COVER
Artist Frank Lacano executes an aerial view of the sprawling International Business Machines Corporation (military computer) plant in Kingston, N. Y.

FASTER READER SERVICE: All RS Card inquiries are now handled by electronic computer.

69TH YEAR OF PUBLICATION

February 1960 Vol. 118 No. 2

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Illustrated above are Three of Six Mahon Power Operated Rolling Steel Doors, 17'-0" x 22'-0", installed in Railroad Opening in an industrial plant. In this installation, power operators are located outside and protected from the elements with hoods. In similar installations, power operators can be located inside with through-the-wall drives.

MAHON

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FACTORY

Moving stacks of hefty tote boxes that handle small parts called for conveyorization at this big Eastern plant. But that wouldn't work either – unless they could prevent the slick-surfaced steel boxes from backsliding on inclines over 25°. So the conveyor manufacturer tested various "rough-topped" belts – including the one recommended by the G.T.M. – Goodyear Technical Man. The winner? The G.T.M.'s Wedge-Grip – unequaled for its ability to work on inclines previously considered impossible. Now, in this plant, the slide-prone tote boxes ride up 30° slopes without any backsliding whatsoever. And the belt's self-cleaning, long-wearing cover design will give this user years of trouble-free service.

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FACTORY LETTERS

Readers Deal Wild Hand to "Card-Playing Managers"

Dear Sir:

The "stinging indictments" (of personnel managers who sit around like card-playing firemen) in your article "AMA Lays It on the Line" (FACTORY, January 1960, page 46) should be hand-carried by FACTORY readers to their presidents and personnel managers! Mr. Powell's "incestuous inbreeding" and Mr. Furlong's "no line experience" vividly describe the "trouble with the personnel department" as I have found it in the South and East.

If, through articles like this, you can convince U. S. management that a tour as a foreman is a prerequisite to the personnel manager's desk, you will have created a renaissance in personnel policies.

Further, you will have put "collective bargaining" in its proper perspective for the first time, unless Congress beats you to it and drives it further into the limbo of the legal expert's briefcase.—*J. V. Bennett, Manager of Budgets and Standards, Riegel Paper Corp., Milford, N. J.*

Dear Sir:

Your article "AMA Lays It on the Line" is straightforward and to the point in its descriptions of strong and weak personnel managers. It could be used by many personnel managers as a yardstick to gage their effectiveness.—*W. Jensen, Supervisor, Industrial Engineering Dept., Omaha (Neb.) Plant, Vickers Inc.*

Dear Sir:

I have read your article, "AMA Lays It on the Line," with considerable interest.

Let me say that a poor personnel manager is worse than none at all, and I agree with Walter Powell's statement that personnel managers get more recognition than they deserve.

It is one of the most important jobs in any factory. In our small plant the different personnel work is handled by our factory manager, chief engineer, and superintendents.

Many plants of our size use a line and staff system because the large companies use one. They put in a personnel manager who is not heavy enough—in fact, he's usually more of an employment manager. And the top brass tend to pass everything over to him instead of handling things themselves.—*H. F. W., president, a mid-west company.*

Dear Sir:

I think your treatment of the personnel manager's place in industry is fair and gets to the heart of this major issue. It is instructive, full of new ideas. It's a very good piece.—*John Bayuk, Plant Engineer, Lycoming Div., Avco Corp., Stratford, Conn.*

Dear Sir:

Jack Staley's bold indictment of lethargic personnel managers provided a thought-provoking article. However, I believe that "acting like managers" may be the cause, not the solution to their problem. Look closer, Jack. Too many of the card-playing firemen are inarticulate line management men who, in error, complacently abdicate the personnel function. Enjoyed the article, let's have more.—*Howard M. Van Syckle, Plant Manager, Taylor-Wharton Co., Birmingham, Ala.*

Turn the page

Al Rossoll:
Detroit Area Service Engineer

A Detroit auto maker proved it in the case of:

THE MIDNIGHT DEADLINE

It's four o'clock in the afternoon. The maintenance department of a Detroit auto plant is on the phone to report an accident to a 16,000 pound capacity die handler. The problem is serious... the truck must be ready for the midnight shift, and a needed part —not available from local stock—is 140 miles away in Cleveland.

ELPAR's Detroit service department goes into action. Service engineer George Tomecek heads for Cleveland in his car while partner Al Rossoll begins to organize a repair crew at the plant. Result: the part was delivered, the truck repaired and back in operation by the midnight deadline.

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Begins on page 6

Five Against Six

Dear Sir:

We are interested to know if you, or anyone of your acquaintance, has studied the relative costs of a maintenance crew of sufficient size to do all required maintenance in a five-day week, versus a smaller crew working six days without production on the sixth day. Your help will be appreciated.—*C. A. Beckwith, Supt. of Maintenance, Motor Wheel Corp., Lansing, Mich.*

► We don't recall any specific study of this problem. From our discussion of this subject with maintenance managers, we conclude you could marshal good arguments for both sides.

One maintenance manager boasted that he rarely permitted Saturday work, that his men liked it that way. And his plant was in tip-top shape. Another manager told us he found it cheaper to pay premium time for Saturday work. Also, the work could be done more efficiently when the equipment wasn't running. A third manager told us his maintenance men would grumble if he cut their premium time—morale would sag. Therefore, he preferred to work with fewer men on a six-day basis. It looks as though it would be a 'six-of-one and half-a-dozen of the other" choice in most cases.—ED.

Burnham Ricochet

Dear Sir:

I enjoyed the article, "Big Company VP Takes Aim at 1960 Costs" in your December issue (page 59). If more companies would take this same aggressive action they could reduce their costs, too. But I disagree very much with two of Mr. Burnham's comments on wage incentives:

(1) "We believe that measured day work is a better way to plan and control production." It is true that measured day work can be an effective incentive for machine-controlled operations. But this

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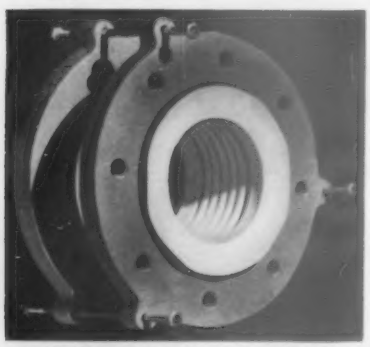
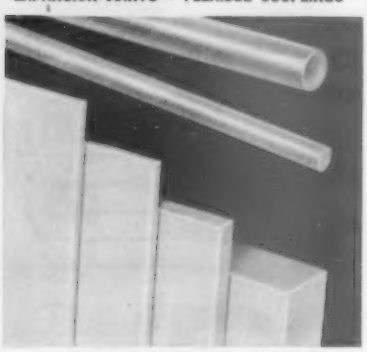


EXPANSION JOINTS • FLEXIBLE COUPLINGS



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TEFLON FLEXIBLE COUPLINGS: Nominal pipe sizes: 1″, 1½″, 2″, 3″.

TEFLON SHEET: 24″ x 24″ in thicknesses 1/32″, 1/16″, 1/8″, 3/16″, 1/4″, 1/2″. 36″ x 36″ and 48″ x 48″ in thicknesses 1/16″ and 1/8″.

TEFLON TAPE: 12″ continuous width in thicknesses .010″, .020″, .030″. 24″ continuous width in thicknesses .010″, .015″, .030″, .060″.

TEFLON ROD: Lengths to 6 ft. in nominal rod sizes 3/16″ to 1/2″ in 1/16″ increments; 1/2″ to 1¼″ in 1/8″ increments; 1¼″ to 2″ in ¼″ increments.

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BELMONT

FACTORY / LETTERS
Begins on page 6

is not true for operations that are controlled by an individual.

(2) "Incentives simply try to encourage people to work harder." Not so. Incentives—properly installed and maintained—are one of the strongest tools management has to increase productivity and decrease costs. Wage incentives have helped give our country its high standard of living.

Ali Mr. Burnham's statements regarding wage incentives assume that the company has done a poor indoctrination job on the employees, has not itself maintained the incentive, or has not trained the foremen in its proper use.

I would like to compete cost-wise with Mr. Burnham in making the shoes and clothes he is wearing.—*John A. Patton, Executive Vice President, George Fry & Associates, New York.*

October Ends Despair

Dear Sir:

Mr. Healy's "Shift Scheduling Made Easy," (your October issue, page 87) appeared after we had almost despaired of finding anything on the subject.

The Management Engineering and Improvement Branch, USAF Headquarters, asks permission to use the article in two publications.—*R. N. Baker, Lt. Col., U.S. Air Force, Washington, D.C.*

FACTORY

February 1960 Vol. 118, No. 2

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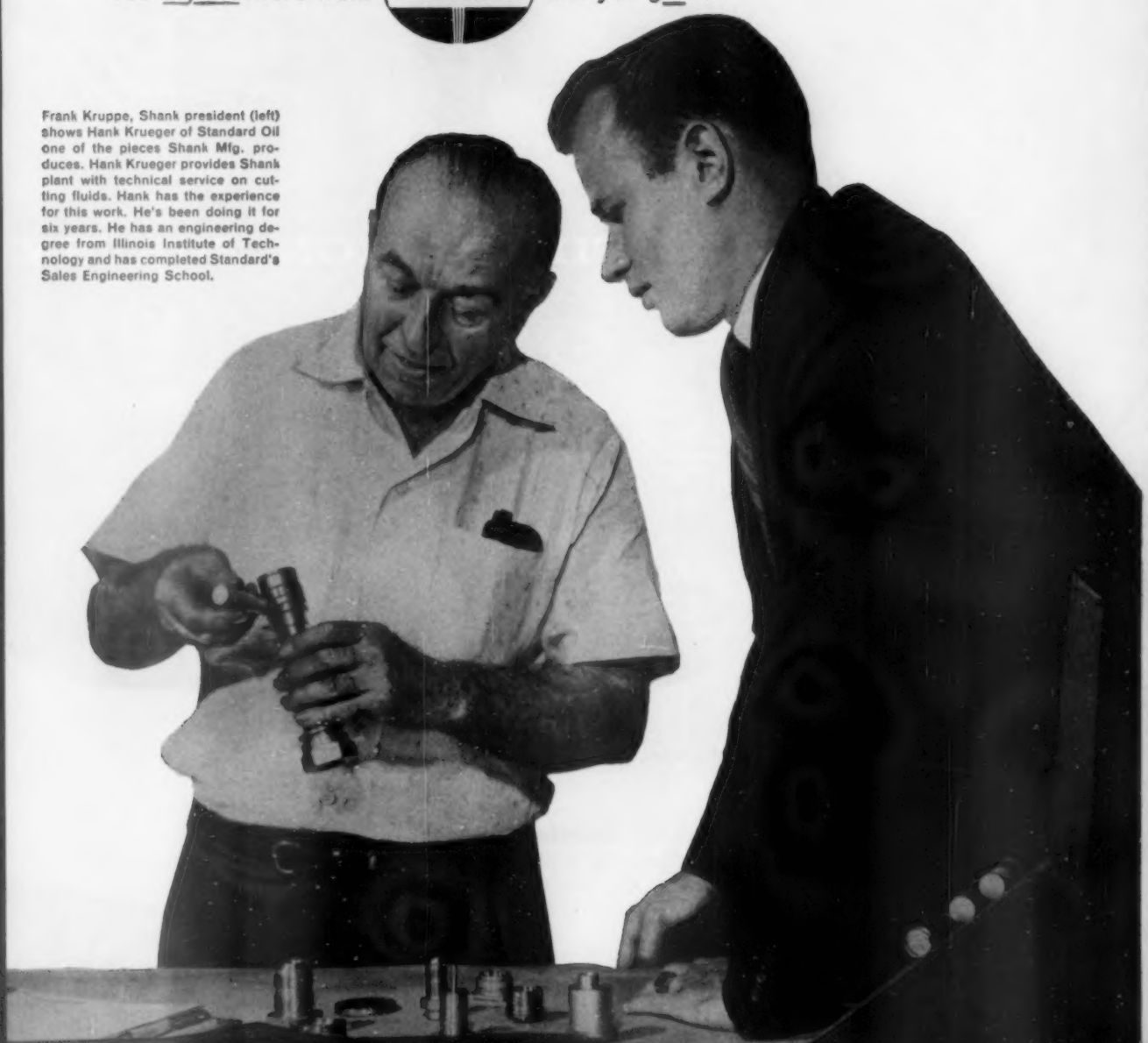
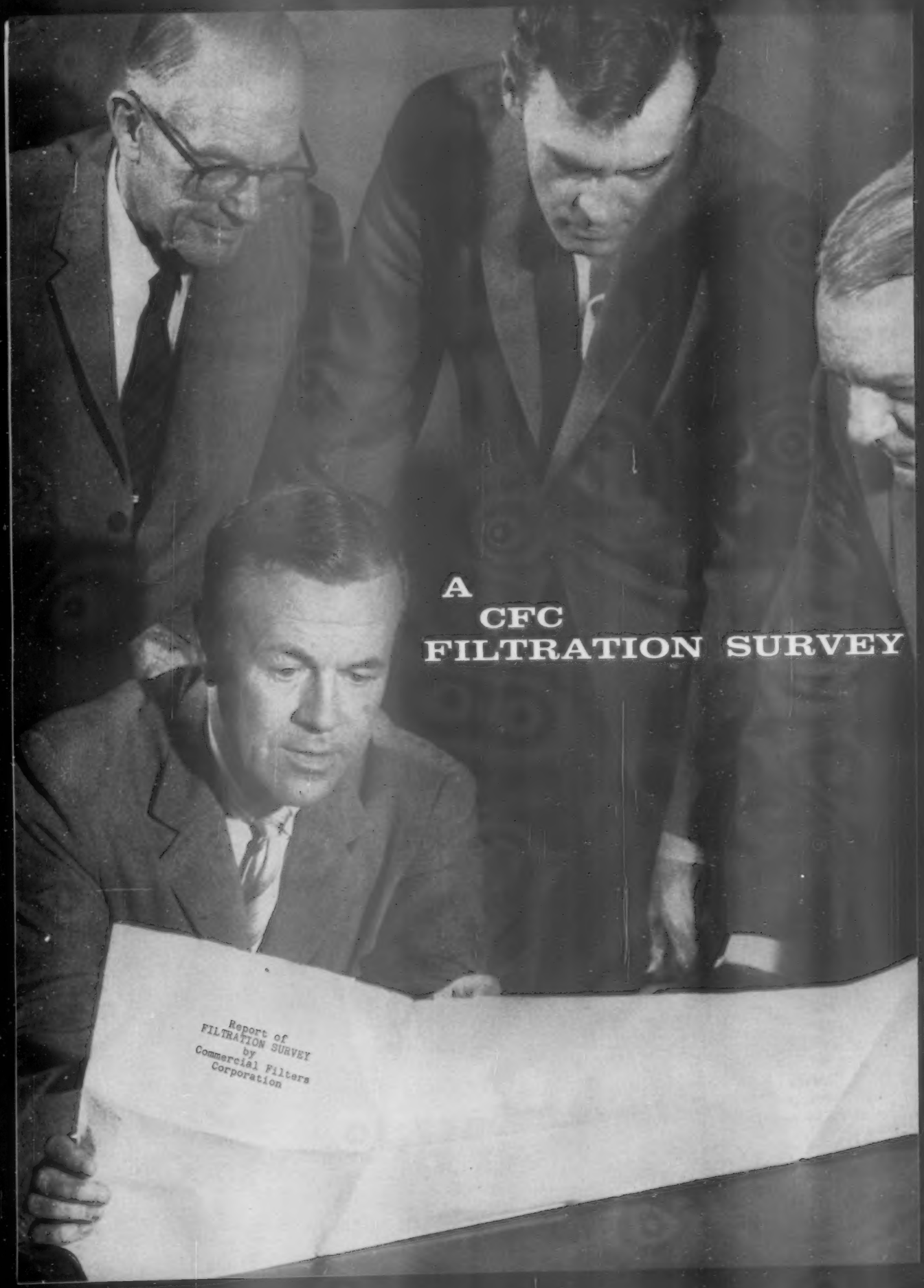
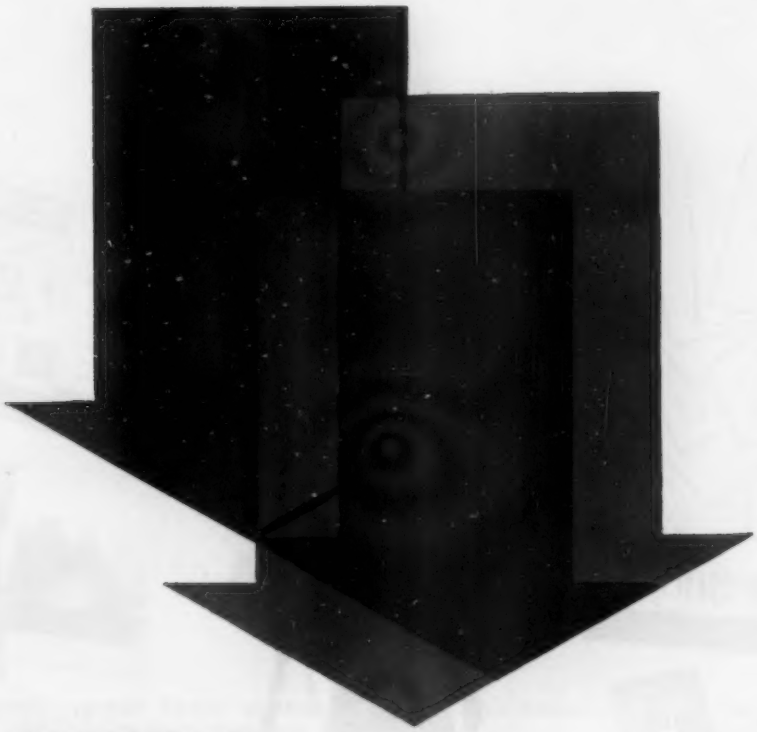
You expect more from STANDARD *and you get it!*



Frank Kruppe, Shank president (left) shows Hank Krueger of Standard Oil one of the pieces Shank Mfg. produces. Hank Krueger provides Shank plant with technical service on cutting fluids. Hank has the experience for this work. He's been doing it for six years. He has an engineering degree from Illinois Institute of Technology and has completed Standard's Sales Engineering School.


A
CFC
FILTRATION SURVEY
Report of
FILTRATION SURVEY
by
Commercial Filters
Corporation



. . . may save you thousands of dollars

Wherever industrial fluids . . . chemicals, gases, oils, water . . . are used in processing and production, CFC micro-filtration can bring you substantial savings.

Versatile CFC Filtration Equipment provides continuous micro-clarity for all types of industrial needs . . . results in improved product quality, lower maintenance and production costs, and decreased downtime.

At no obligation, a qualified CFC Filtration Engineer will survey your plant and recommend micro-filtration wherever it will save you money. Write to Dep't. FA.

Filter out high costs . . . ***with CFC Filters***

CFC

COMMERCIAL FILTERS CORPORATION

Fulflo Horan-Crane Delpark Michiana

MELROSE 76, MASSACHUSETTS

PLANTS IN MELROSE, MASS. AND LEBANON, IND.

For more facts Circle 391 on Reader Service Card

PRODUCTION WITHOUT ACCIDENTS in the SMALLER BUSINESS
3. SMALL PLANT SAFETY
YOUR PLANS for TOMORROW
depend on SAFETY TODAY
4. SAFETY POSTERS
PROTECTIVE GEAR?
— you bet your life pa!
HEADS you win!
cutting corners invites disaster
SAFEGUARDS
LOSS CONTROL
5. LOSS CONTROL MAGAZINE
ENGINEERING ASPECTS of PROPERTY DAMAGE PREVENTION
FOREMANSHIP in ACCIDENT PREVENTION in CONSTRUCTION
SURFACE CONSTRUCTION
2. TECHNICAL BOOKS
1. INDUSTRIAL HYGIENE
6. EDITOR'S SAFETY SERVICE

"Extras" available to AM policyholders at no extra cost!

American Mutual's special safety engineering services help policyholders keep down the cost of Workmen's Compensation.

Backing up every AM Safety Engineer in his vital work of helping policyholders prevent accidents and control losses are these special safety services:

1. **TO HELP CONTROL** occupational disease . . . a modern laboratory staffed with chemical engineers who analyze toxic hazards—including radioactive materials.

2. **TO EDUCATE FOREMEN** in industrial accident prevention . . . a series of technical books prepared by AM Safety Engineers.

3. **TO HELP PREVENT** accidents in smaller and multiple location operations . . . a ten-part correspondence course, "Production Without Accidents in the Smaller Business."

4. **TO HELP STRENGTHEN** policyholder plant safety programs . . . a monthly service of multi-colored safety posters.

5. **TO TELL POLICYHOLDERS** about the latest techniques in accident control . . . an authoritative safety publication issued every four months.

6. **TO PROMOTE EMPLOYEE SAFETY** on and off the job . . . a special series of illustrated safety ideas for use by editors of policyholders' employee magazines.

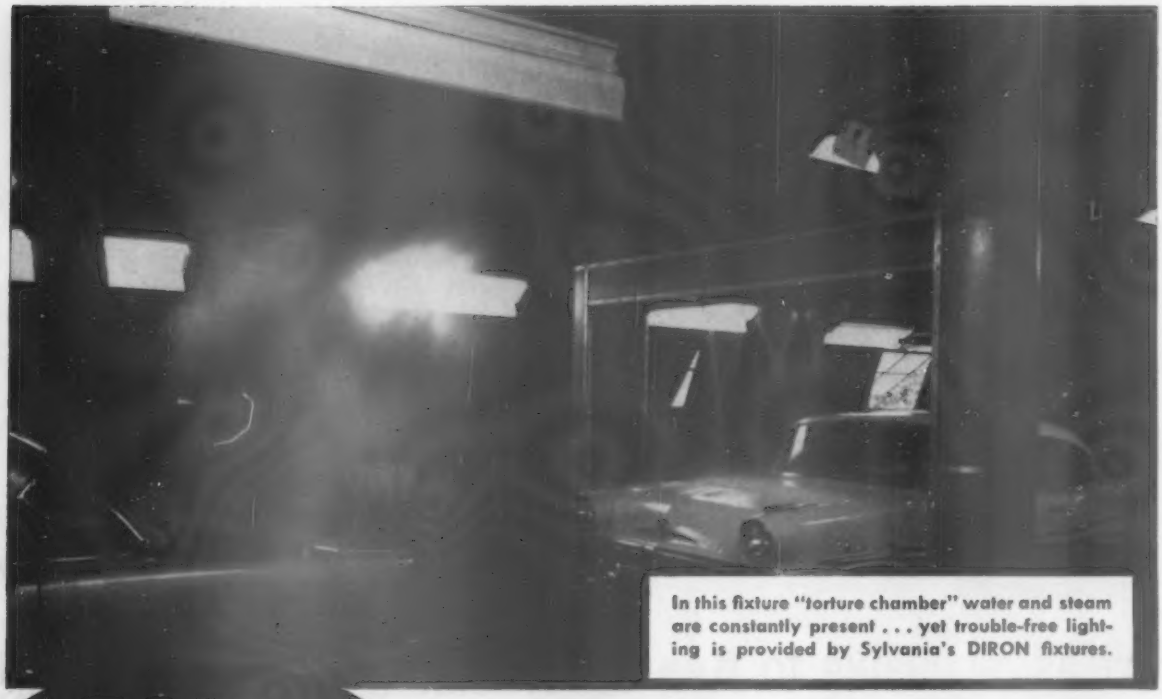
* * *

Add these cost-cutting "extras" to the savings opportunities through AM dividends (policyholders received nearly $8,500,000 in 1958) and it gives you good reason to talk to the *friendly AM man* now. (He can advise you on all your casualty insurance needs.) American Mutual, Dept. F-1, Wakefield, Mass.

American Mutual

LIABILITY INSURANCE COMPANY

"The First American Liability Insurance Company"... a leading writer of Workmen's Compensation, all forms of Liability, Crime, Automobile, Group Accident and Health Insurance.



In this fixture "torture chamber" water and steam are constantly present . . . yet trouble-free lighting is provided by Sylvania's DIRON fixtures.

now... *True All-Porcelain Fixtures for Extreme Humidity Conditions*

Sylvania's New DIRON Fixtures

Here is a new, important advancement in fluorescent lighting fixtures . . . especially for textile mills, laundries, tanneries and other high humidity locations.

Selected Sylvania fixtures—both industrial and open-type—now have the new DIRON finish, a super-thin, all-porcelain process.

Every external part of these fixtures—*even the lampholder cases* for multi-lamp units—is protected against moisture by this exclusive DIRON process.

By this new method a tough, durable layer of porcelain is applied to *all* exposed surfaces of the fixtures. Yet the finish is so strong and pliable that knockouts can be removed without damaging the porcelain protection.

You'll find these fixtures both practical *and* economical. The new DIRON fixtures cost much less than conventional all-porcelain units. And the price is so close to that of standard industrial fixtures that you'll want to use DIRON units when there is any chance of a high humidity or corrosive atmosphere.

For full information on Sylvania DIRON fixtures, write to:

SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
One 48th Street, Wheeling, West Virginia

GO MODERN WITH LIGHTING BY SYLVANIA

Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

FLUORESCENT LIGHTING FIXTURES AND SYSTEMS • BEST FIXTURE VALUE IN EVERY PRICE RANGE

For more facts Circle 393 on Reader Service Card
For more facts Circle 394 on Reader Service Card ➤

New from American-Standard
Industrial Division

Power-Lift† for Power Plants

Power-Lift is a timely new concept of coordinated products and services from American-Standard Industrial Division. Its purpose is to help you raise overall efficiency in your plant by offering *products* that are proved in the field and designed, engineered, and manufactured to a uniform standard of quality and performance . . . with *service* by product specialists in every principal city.

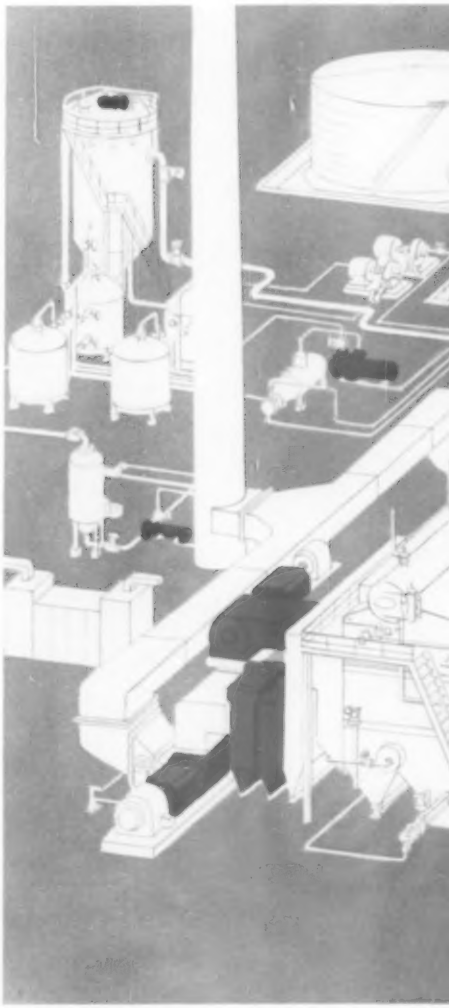
To see how Power-Lift services can benefit you . . .

← LIFT THE FLAP

† Service-mark of American-Standard

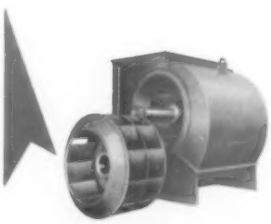
1959

Early in 1959 three American-Standard divisions—American Blower, Ross Heat Exchanger, and Kewanee Boiler—were combined into a single organization under a new name: American-Standard Industrial Division. The year 1959 was spent fruitfully—consolidating product lines, accelerating new product development, gearing up to meet the stepped-up requirements of the fast-paced, highly specialized power industry.



1960

Today, we're confident that you'll find new benefits in specifying products from American-Standard Industrial Division . . . products that now encompass the major fields of heat transfer, mechanical draft, boiler feed pump and fan control, fly ash and dust control, heating, ventilating, and air conditioning. The illustration at right shows where many of these products may be applied in a modern steam plant. Each is designed, engineered, and manufactured to help you produce power efficiently and economically. Each is backed by an honestly won reputation for reliability on the job.

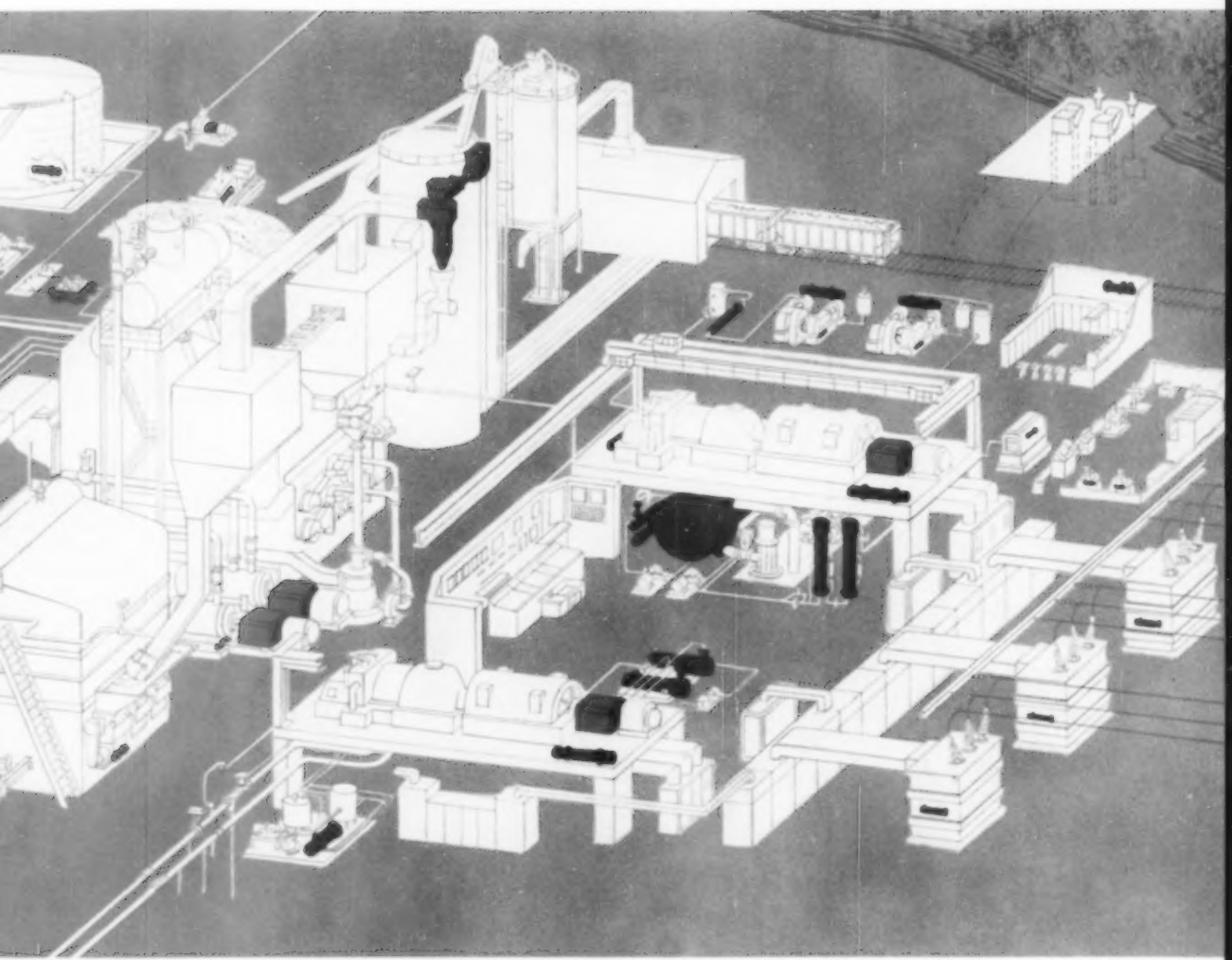


Mechanical Draft Fans

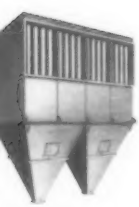
Dust
C

COPYRIGHT 1959, AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

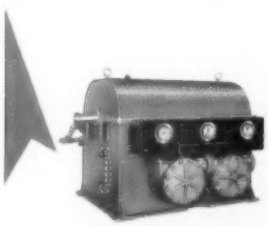
CTION



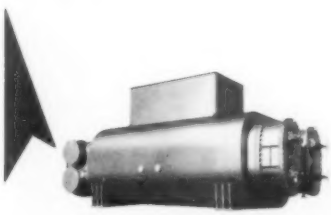
Here's where some of American-Standard Industrial Division products serve in a modern power plant.



ust and Fly Ash
Collectors



Gyrol® Fluid Drives for fan
and feed pump control



Surface Condensers
and Feedwater Heaters

Heat Exchangers
and After Coolers

As Near as Your Phone

American-Standard Industrial Division Power-Lift Products and Services

Talk over your requirements with an American-Standard* Industrial Division product specialist. You'll find him well prepared and experienced—frequently able to base equipment recommendations upon precedents of proved success. And, in many instances, our comprehensive standardization paves the way to savings in time and cost. Offices in all principal cities. AMERICAN-STANDARD INDUSTRIAL DIVISION, DETROIT 32, MICHIGAN. IN CANADA: AMERICAN-STANDARD PRODUCTS (CANADA) LIMITED, TORONTO, ONTARIO. EXPORT DIVISION, AMERICAN-STANDARD, NEW YORK CITY.

SURFACE CONDENSERS

Designed to service the largest of today's and tomorrow's steam turbines. Low bundle entrance velocity; liberal steam transportation lanes; moisture impingement grids to extend tube life; expansion diaphragms; effective de-aeration and many other features created during 40 years of surface condenser development and research.

MECHANICAL DRAFT FANS

Complete range of sizes and types for forced draft, induced draft, gas recirculating, and primary air fan applications. Designed to meet rigid requirements of modern power plants where maximum pounds of steam are produced daily at peak efficiency. Airfoil, forward curved, backwardly inclined, radial, radial tip blades.

FEEDWATER HEATERS

Design incorporates unique new High Pressure closure. Maintenance is simplified with only four major parts. Exceptionally high safety factor built into all units—more than double ASME Code requirements. Temperature stresses from start-ups or load changes virtually non-existent.

HEAT EXCHANGERS

Designed and built with thoroughness and precision. Standard or specially engineered units for virtually all conditions and applications, including high pressure-high temperature exchangers, compressor inter- and after-coolers, fuel oil heaters, blow-down exchangers, and many others.

GYROL® FLUID DRIVE

Provides stepless adjustable speed control for fans and boiler feed pumps. Performance, power savings, and reliability proved in the field. Units for motor driven boiler feed pumps or for "on-the-shaft" duty on main turbine generator. Drives are available for fan and pump duties for all boiler sizes.

DUST AND FLY ASH COLLECTORS

Type "D" Dust Collector: mechanical "cyclone-type" collector. Series 342 Dust Collector: uses "cyclone" principle, with individual tubes which permit flexibility in design to fit plant layout. Series 361 Dust Collector: combines primary and secondary systems for high efficiency fly ash recovery.

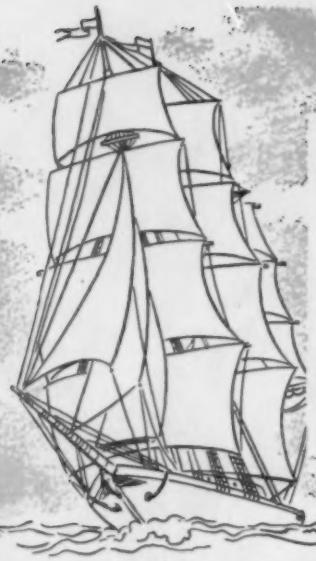
*American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
INDUSTRIAL DIVISION

AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

Why Rust-Oleum is different—

and what this difference, backed by 35 years of industry proof, means to you!



A Sea Captain developed it . . . Industry proved it!

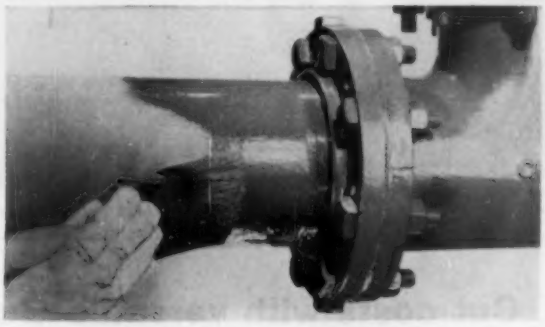
The original Rust-Oleum formula was developed nearly fifty years ago by Sea Captain Robert Fergusson, who became intrigued with the rust-stopping qualities of fish oil early in his career. Creating a *special treatment* for the fish oil, he used the *specially-processed fish oil* as the vehicle in combination with fine rust-inhibiting pigments. The result? A coating that actually *stopped rust* when applied directly over sound rusted surfaces, after scraping and wirebrushing to remove rust scale and loose rust. Possible, because the *specially-processed* fish oil penetrated the rust to bare metal. This was the birth of Rust-Oleum's *exclusive* 769 Damp-Proof Red Primer.

PROVED THROUGHOUT INDUSTRY FOR OVER 35 YEARS

Today, Rust-Oleum in its many systems and colors, has been proved throughout industry for over thirty-five years. This proof by leading industrial users is your assurance of savings in time, money, and metal. Economies made possible by the fact that Rust-Oleum 769 Damp-Proof Red Primer goes right over the sound rusted metal—usually eliminating costly surface preparations. And Rust-Oleum, in its various systems, resists rain, sun, fumes, heat, weathering, chemicals, etc., for lasting beauty over the years.

RUST-OLEUM NEW COLOR HORIZONS SYSTEM

The Rust-Oleum New Color Horizons System introduces a new coating concept to industry. It combines four important factors: (1) the ability to stop rust, (2) smart, modern color harmony, (3) the durability to last and last, (4) ease of application that saves time, money, and metal. See how this system can bring lasting beauty to your plant, machinery, equipment, pipes, tanks, structural steel, fences, etc. Write for complete information or contact your nearby Rust-Oleum Industrial Distributor. He maintains complete stocks for prompt service.



RUST-OLEUM®

There are imitations, but only *one* Rust-Oleum. It is distinctive as your own fingerprint.

STOPS RUST!®

ATTACH TO YOUR LETTERHEAD

Rust-Oleum Corporation
2517 Oakton St., Evanston, Illinois

Please send me the following at no cost or obligation:

- ☐ New Color Horizons Systems Catalog featuring 110 actual color standards and 69 photo applications.
- ☐ Free test sample of Rust-Oleum 769 Damp-Proof Red Primer to be applied over sound rusted surface.
- ☐ Results of radioactive tracing study on Rust-Oleum fish oil penetration.

For more facts Circle 395 on Reader Service Card

Custom rolling sheet aluminum at Sheet Aluminum Corporation, Jackson, Michigan. All hydraulic systems in the plant are filled with Gulf Harmony oil. Photo shows processed aluminum being wound on tension reel at delivery end of mill.

Cut costs with versatile Gulf Harmony® for plant lubrication

GULF MAKES THINGS

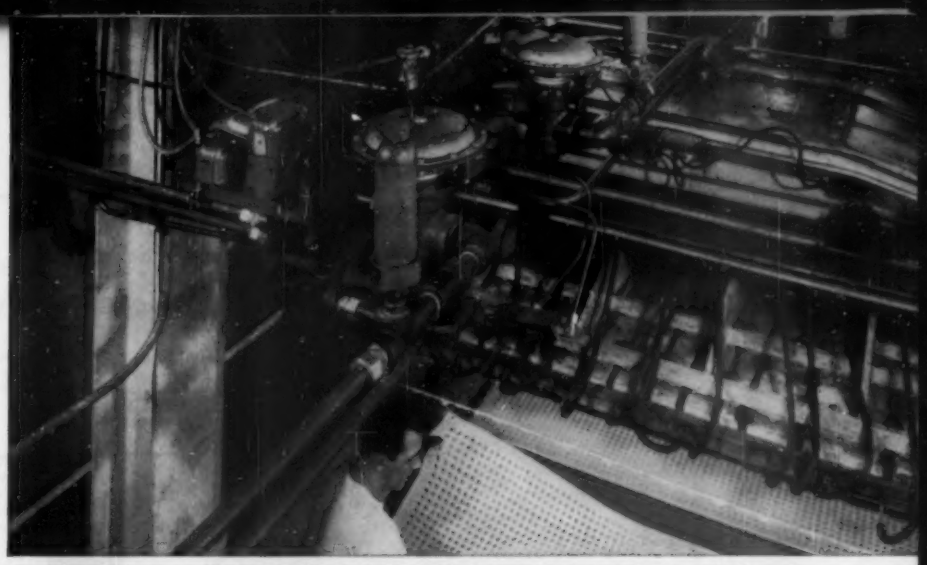
Using numerous special purpose lubricants? Here's relief. You can meet virtually every oil requirement in your plant—including fluid power for hydraulic systems—with Gulf Harmony.

In central lubricating systems, hydraulic systems, in the lubrication of dryer roll bearings, air compressors, blowers, machine tools, electric motors and a host of other applications—Gulf Harmony can save you money and simplify your oil problems.

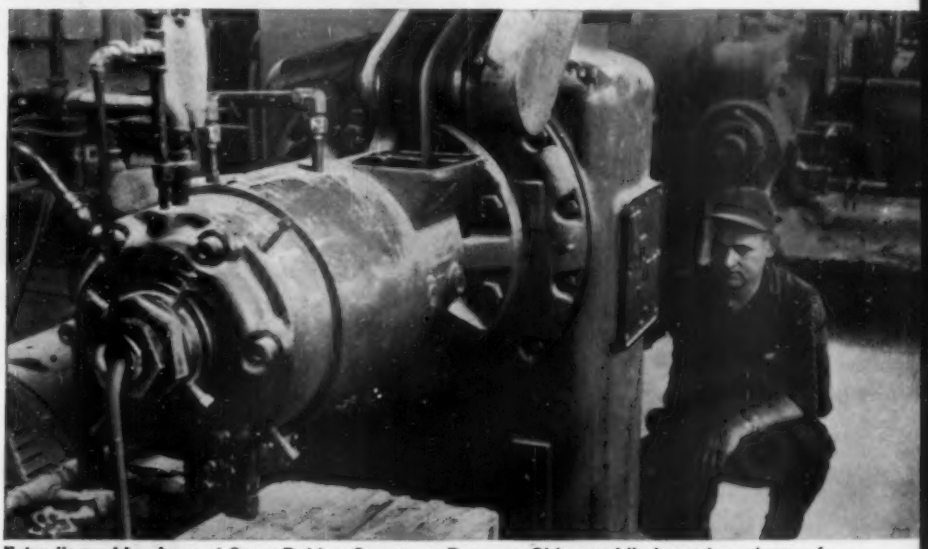
The unusually high oxidation resistance of Gulf Harmony assures longer life—for both machine and lubricant—and freedom from harmful sludge deposits.

In addition, Gulf Harmony maintains its original viscosity and color stability for exceptionally long periods.

A patented anti-foam agent in Gulf Harmony prevents objectionable foaming. And there is a strong anti-corrosion additive that protects against rust. Gulf Harmony oil performs remarkably well in bearings exposed



Moulding Texfoam mattresses at the B. F. Goodrich Sponge Products Division, Shelton, Connecticut. Here, through hydraulic equipment as shown in upper foreground, Gulf Harmony supplies fluid power for 125 moulding presses.



Extruding rubber hose at Swan Rubber Company, Bucyrus, Ohio, world's largest producer of garden hose. The many precision gears in the speed reduction units of the extruder shown here operate in a bath of Gulf Harmony oil.

and hydraulic systems . . . see how

RUN BETTER!

to high ambient temperatures and humid atmospheres.

You name the application—and your Gulf Sales Engineer will gladly recommend the proper grade of Gulf Harmony. He'll also show you how this versatile oil can help cut your maintenance costs and simplify your lubricant storage and handling.

If you have a lubrication problem at your plant, we invite you to see how Gulf makes things run better. Just call your nearest Gulf office, or mail the coupon.

GULF

GULF OIL CORPORATION
Dept. DM, Gulf Bldg., Pittsburgh 30, Pa.

Please send latest illustrated bulletin on Gulf Harmony.

Name_____
Title_____
Company_____
Address_____
City_____ Zone____ State_____

For more facts Circle 396 on Reader Service Card

The Bostitch Economy Man can give you quick and effective answers to many knotty production fastening questions.

One reason is that he has over 800 staplers and more than 200 staples to work with. Quite possibly, he'll be able to suggest a way to give you benefits beyond those you expect.

For example, if you need faster fastening, he may be able to give you more speed with greater fastening strength. Or he may give you exactly the kind of fastening you need at a lower cost than you'd expect.

When you need fastening information or help, call in your Bostitch Economy Man. He'll be glad to help you with data from the largest source of facts in the stapling industry. He's listed under "Bostitch" in your phone book. Or, write us direct if you wish.

Fasten it better and faster with

With every Bostitch machine you get...

assurance of the right combination for your needs from 800 staplers and over 200 staples . . . an extra margin of quality . . . nation-wide parts, service and technical aid . . . dependable supply from the industry's most modern factory . . . and we stand behind every Bostitch machine, making sure it operates to your complete satisfaction.

BOSTITCH®

STAPLERS AND STAPLES

602 BRIGGS DRIVE, EAST GREENWICH, RHODE ISLAND

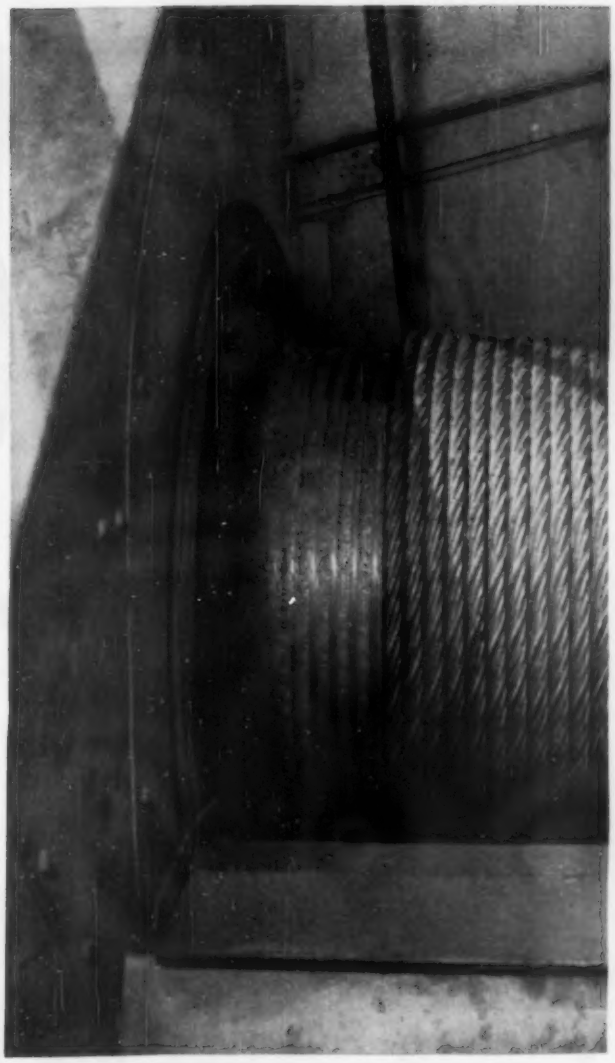
FACTORY

For more facts Circle 397 on Reader Service Card

Herringbone's two pairs of Lang lay strands and one pair of regular lay strands provide the ideal combination of maximum flexibility with good stability.

Finer wires inside contribute to Herringbone's excellent drum-winding characteristics.

Heavier outside wires in each strand have greater resistance to abrasion.



"...we would never hesitate to recommend it"

GRAY & FEAR, CONTRACTORS

This company continues: **"We have been using your Roebling Herringbone* for about one year. We find it is one of the best ropes we have ever used, outlasting previous ropes three to one. It is good that such a reliable rope is available."**

This is a direct field quote on the most remarkable development in wire rope in years...a new concept in wire rope design. Roebling Herringbone is the regular lay and Lang lay wire rope —two-ropes-in-one rope—combining the best features of both.

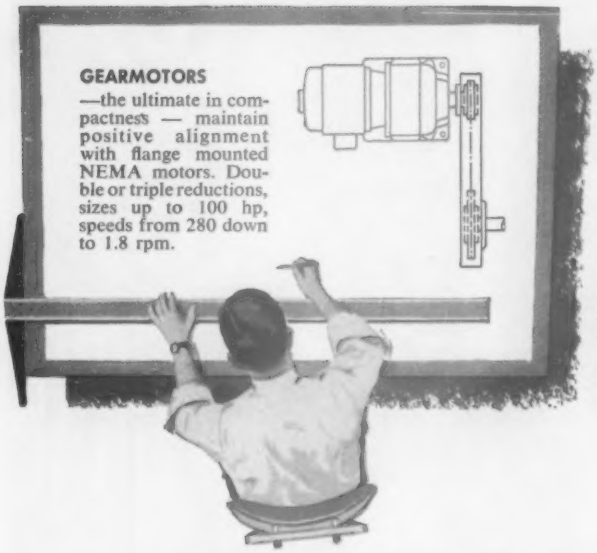
Herringbone delivers extra flexibility, extra abrasion resistance, unusual structural stability, extra resistance to shock, easy operation over sheaves and drums and smooth spooling properties.

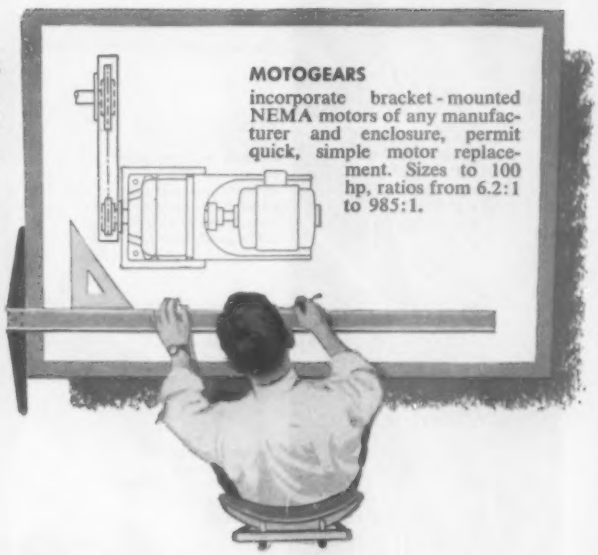
We recommend Herringbone without reservation for general hoisting and the entire range of heavy-duty equipment. Your Roebling Distributor or Roebling's Wire Rope Division, Trenton 2, New Jersey, will give the full and fabulous details. *Reg. App. For

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

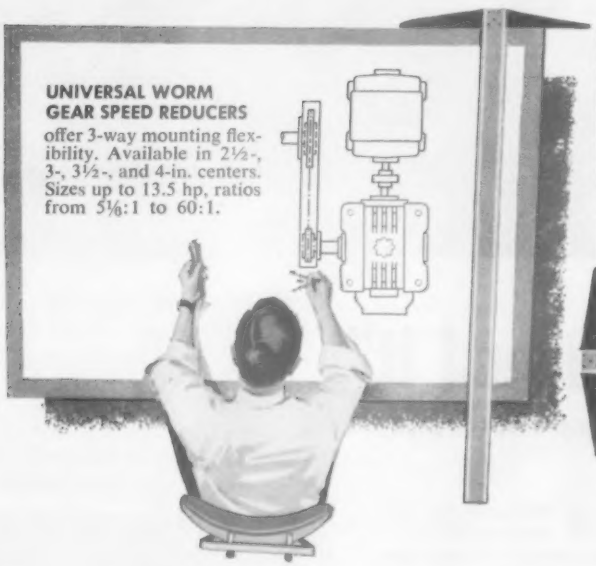
For more facts Circle 398 on Reader Service Card

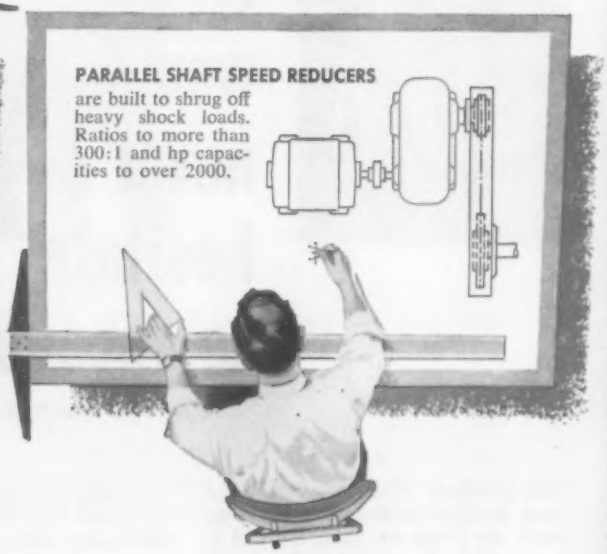

GEARMOTORS
—the ultimate in compactness — maintain positive alignment with flange mounted NEMA motors. Double or triple reductions, sizes up to 100 hp, speeds from 280 down to 1.8 rpm.

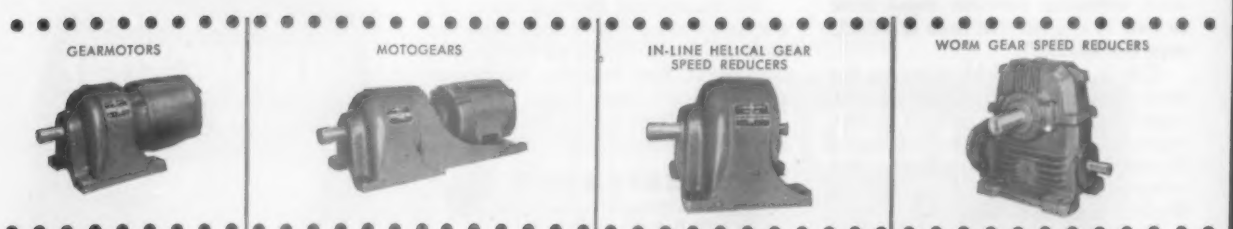

MOTOGEARS
incorporate bracket - mounted NEMA motors of any manufacturer and enclosure, permit quick, simple motor replacement. Sizes to 100 hp, ratios from 6.2:1 to 985:1.

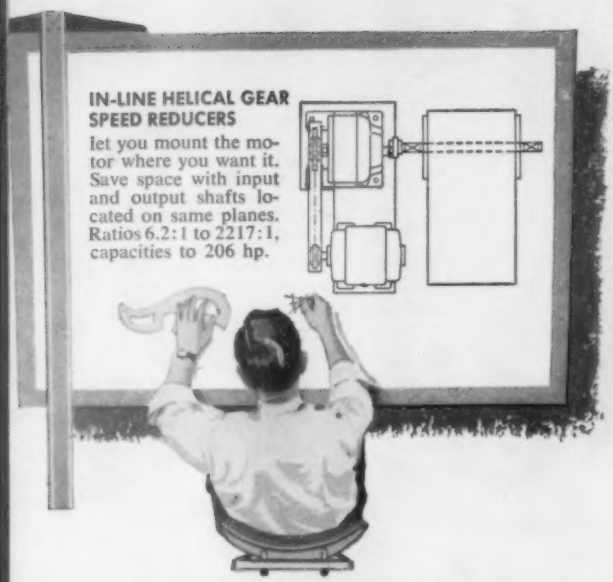
It's industry's only complete line—

don't limit


UNIVERSAL WORM GEAR SPEED REDUCERS
offer 3-way mounting flexibility. Available in 2½-, 3-, 3½-, and 4-in. centers. Sizes up to 13.5 hp, ratios from 5⅛:1 to 60:1.

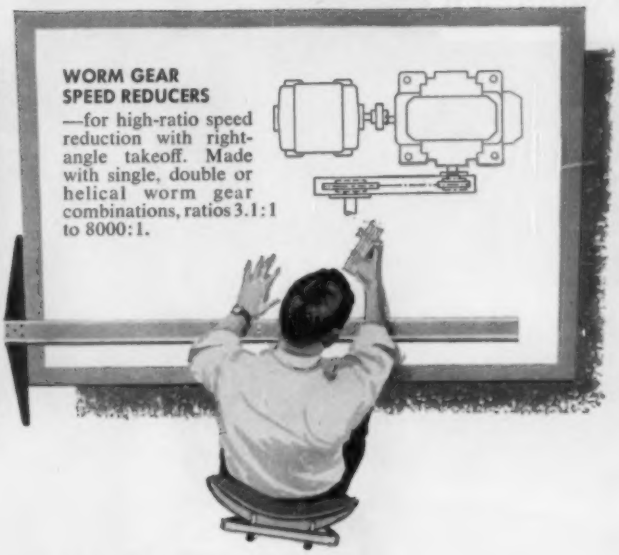

PARALLEL SHAFT SPEED REDUCERS
are built to shrug off heavy shock loads. Ratios to more than 300:1 and hp capacities to over 2000.





IN-LINE HELICAL GEAR SPEED REDUCERS

let you mount the motor where you want it. Save space with input and output shafts located on same planes. Ratios 6.2:1 to 2217:1, capacities to 206 hp.

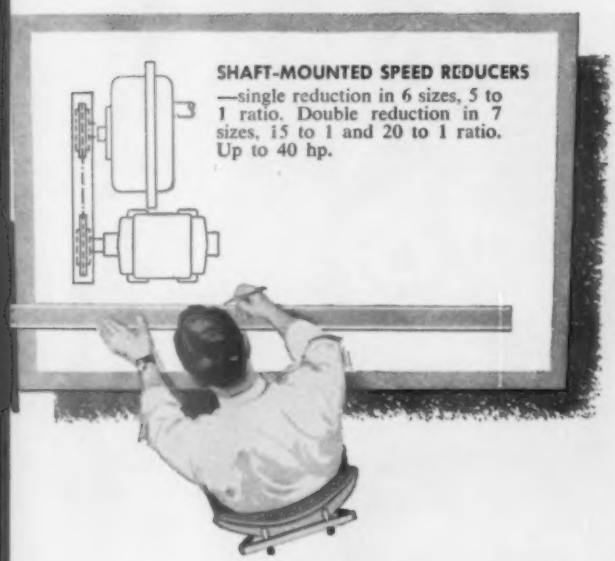


WORM GEAR SPEED REDUCERS

—for high-ratio speed reduction with right-angle takeoff. Made with single, double or helical worm gear combinations, ratios 3.1:1 to 8000:1.

that's why LINK-BELT speed reducers

your layout



SHAFT-MOUNTED SPEED REDUCERS

—single reduction in 6 sizes, 5 to 1 ratio. Double reduction in 7 sizes, 15 to 1 and 20 to 1 ratio. Up to 40 hp.

Yes, you can plan with full freedom when you rely on LINK-BELT. *Seven* basic types of speed reducers—each in a wide range of sizes and ratios—give you complete flexibility in drive layout. It's easy to select the one that *exactly* meets your requirements for ratio, space, shaft position, shock loading and other specific factors.

And Link-Belt's leadership in speed reducers extends to every area of power transmission equipment. Link-Belt makes all related drive components—chain and sprockets, bearings, couplings—all dimensionally correlated with these reducers. This one-source responsibility eliminates need to exchange drawings with other suppliers and assures a matched set of equipment.

For full facts on Link-Belt's comprehensive line of speed reducers—including selection and features data—get in touch with your nearest Link-Belt office or authorized stock-carrying distributor.

LINK-BELT

SPEED REDUCERS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.

UNIVERSAL WORM GEAR SPEED REDUCERS

SHAFT-MOUNTED SPEED REDUCERS

PARALLEL SHAFT SPEED REDUCERS

QUICK DELIVERY FROM STOCK.

Distributors, backed by 16 warehouses strategically located throughout the United States, assure immediate availability of all popular sizes of Link-Belt speed reducers.

15,147

Lift truck stacks packaged grocery items in Publix warehouse. Loads run up to 3600 lbs. Tires are B.F.Goodrich Deluxe Cushion Smooth Tread.

No tire trouble in 9 years at supermarket warehouse, thanks to B.F.Goodrich TW Analysis

Publix Supermarkets, Inc., operates a chain of 59 stores throughout Florida, services them all from a warehouse in Lakeland. When the warehouse was built in 1951, Publix called in the B.F.Goodrich Tire and Wheel Analysis Man to make industrial tire recommendations.

He studied the warehouse setup—floors, loads, equipment, jobs, etc. Then he advised which B.F.Goodrich industrial tires would give longest service at lowest cost—advice that was unbiased, because BFG makes a complete line of industrial tires. Publix followed his recommendations, and today—9 years later—the company has *never* had a lift truck out of service because of tire trouble!

This case history is typical of the savings BFG Tire and Wheel Analysis Men are offering industrial tire users all over the country. Why not take advantage of this *free* B.F.Goodrich service. The TW Analysis Man knows industrial tires—knows which ones will solve your materials handling problems best. Mail the coupon below today.

A special B.F.Goodrich consulting service is available for manufacturers of materials handling equipment.

Specify B.F.Goodrich Tires when ordering new equipment

Food products arrive by freight car and tractor-trailer. Lift trucks roll on BFG tires, work 9¼ hours a day, have never been down because of tire trouble in 9 years!

A FREE B.F.Goodrich TW Analysis can save you as much as 50% on industrial tires, as much as 20% on maintenance costs. Mail the coupon now.

The B.F.Goodrich Company
Dept. TW-809, Akron 18, Ohio

Please send me additional information on your free Tire and Wheel Analysis Plan.

Name_____

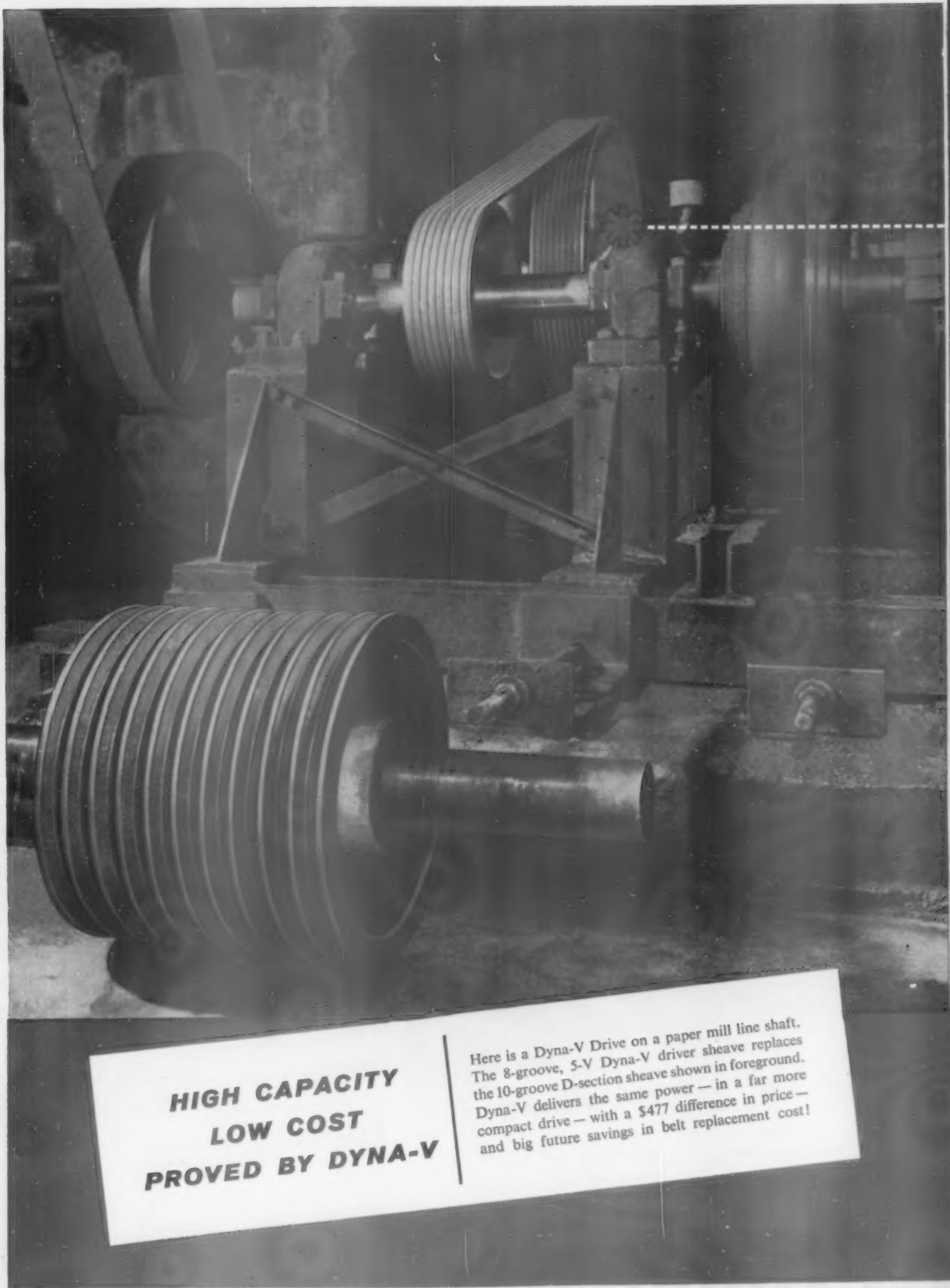
Company_____

Street_____

City_____ Zone____ State_____

B.F.Goodrich *industrial tires*

For more facts Circle 400 on Reader Service Card

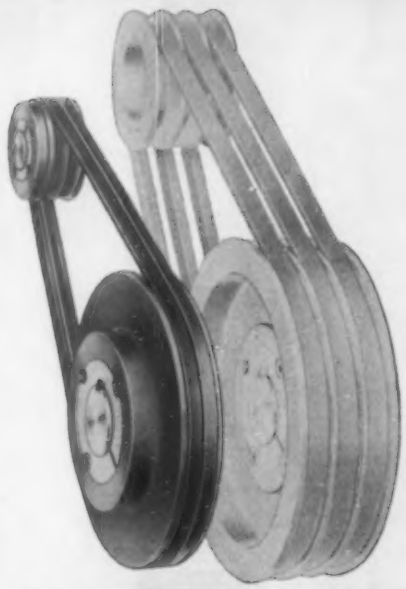


HIGH CAPACITY LOW COST PROVED BY DYNA-V

Here is a Dyna-V Drive on a paper mill line shaft. The 8-groove, 5-V Dyna-V driver sheave replaces the 10-groove D-section sheave shown in foreground. Dyna-V delivers the same power — in a far more compact drive — with a $477 difference in price — and big future savings in belt replacement cost!

Dyna V

THE NEW MONEY-SAVING IDEA IN V-BELT DRIVES!



Dyna-V compared with big-groove drive for same hp. Dyna-V is capable of handling 3 times as much hp in the same space! Dyna-V Drives are available for capacities from 1 to 1500 hp.

The day of big-groove sheaves and belts is passing. The new idea of compact V-belt drives—Dyna-V—introduced by Dodge just a few short months ago, is taking the country by storm. Thousands of Dyna-V Drives are at work in industry everywhere, carrying their loads easily, dependably, and proving their ability to *deliver more horsepower per dollar!*

Dyna-V utilizes the full performance possibilities of today's great synthetic fibers for belts—and modern metals for sheaves. Narrow belt top widths team up with narrow sheave grooves to create Dyna-V compactness. Narrow grooves reduce face width—save weight. Costs are lowered. Smaller diameter sheaves and shorter center distances multiply savings. With Dyna-V you cut costs on most initial installations and economize on belt replacements as well. In medium and high hp ranges these savings can be as much as 30%.

Dyna-V Sheaves decrease shaft overhang—increase bearing life. And Dyna-V Belts possess all premium qualities. Conditions requiring oil, heat, moisture resistance or static conductivity are met by Dyna-V's one grade—the finest. Ask your local Dodge Distributor. Or write us for Dyna-V Bulletin.

CALL THE TRANSMISSIONEER — your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery".

DODGE
of Mishawaka, Ind.

DODGE MANUFACTURING CORPORATION, 400 UNION STREET, MISHAWAKA, INDIANA

For more facts Circle 401 on Reader Service Card

For more facts Circle 402 on Reader Service Card ➤

ALL SIZES, ALL BODY PATTERNS FOR ALL APPLICATIONS

BALANCED VALVES
— for air, steam, water, gas. Designed for applications where close control is required, where pressures exceed those of single-seated valves, and where tight closing is not required. Double-seated construction, approximately 98% tight closing. Sizes ½" to 14". Wide choice of models, capacities and operating features.

COIL VALVES
— for medium pressure steam, liquid, air or gas. Long-life molded rubber diaphragms. ½" to 6" sizes. Body patterns and features for many applications.

CONVECTOR VALVES
Compact size for installation in confined spaces, inside or outside convector enclosures. Models for low pressure steam, hot and cold water. All models have "Sylphon" metal bellows operators. Sizes ½" and ¾".

LIQUID VALVES
— for low pressure hot or cold water service. Choice of molded rubber diaphragms or seamless "Sylphon" bellows. Removable tops. Wide choice of features and body patterns. Sizes ½" to 8".

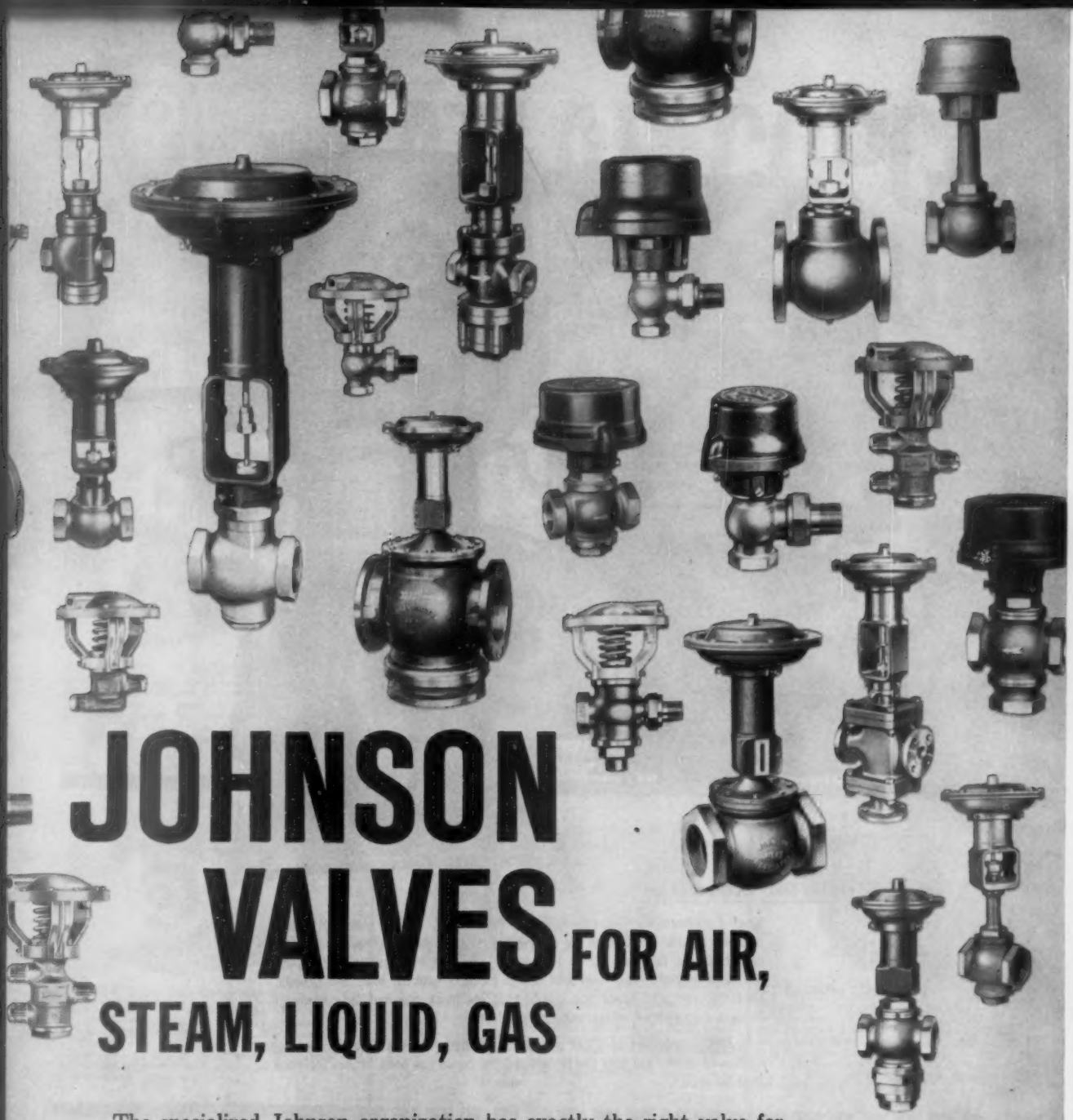
MIXING VALVES
— for applications requiring the mixture of liquids at different temperatures under control of a thermostat or humidostat. "Sylphon" and rubber diaphragm operators. Removable tops. Available in ½" to 10" sizes. Body patterns and operating features for every application.

BY-PASS VALVES
— for control of liquids over a wide range of temperatures and pressures. Sizes ½" to 6". Models available with 100% tight shutoff. Removable operators.

WATER VALVES
— especially designed for use with small room air conditioning and heating units. High grade bronze bodies. Rubber diaphragm operators. Corrosion resistant throughout. V-ring self-sealing packing assures positive seal. Renewable composition discs. Sizes ½" and ¾".

STEAM VALVES
— for control of low pressure steam. Rubber diaphragm or seamless "Sylphon" operators. Renewable composition discs especially compounded for steam service. Sizes ½" to 10". Choice of body patterns and features.

BRINE VALVES
— for control at pressures up to 50 psi. Cast iron or bronze bodies. Rubber diaphragm or "Sylphon" operators. Renewable discs, especially compounded for brine service. Removable tops. Sizes ½" to 8" in a variety of body patterns.



JOHNSON VALVES FOR AIR, STEAM, LIQUID, GAS

The specialized Johnson organization has exactly the right valve for every possible air-conditioning, heating, or ventilating control system application. In fact, Johnson makes the most complete line of pneumatic equipment in the industry — for solving any problem of temperature, humidity, or pressure control.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

JOHNSON SERVICE COMPANY
507 East Michigan St., Milwaukee 1, Wisconsin

- ☐ Have a Johnson engineer call on me.
- ☐ Send your new condensed catalog of all type of Johnson Pneumatic Control equipment.

Name_____

Title_____

Firm_____

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ER-6
Heavy-Duty Compressors

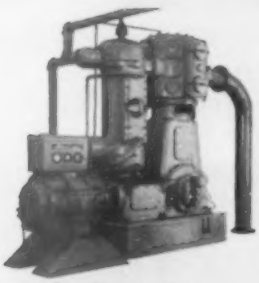
New! Fundamental improvements over conventional, typical heavy-duty compressors provide these three big advantages: (1) Only 18.3 hp required per 100 cfm at 100 psi, full load—10 to 15% lower than most compressors of this size! (2) Completely enclosed functional design protects external lines and fittings. (3) Extremely small space and simple concrete block required for permanent fixing—save on floor space, material and labor!

Plus—capacities to 1,140 cfm; standard instruments and safety devices; built-in reliability and long life for which Atlas Copco has been famous for more than 50 years!

Atlas Copco Atlas Copco Atlas Copco

Which... ATLAS COPCO COMPRESSOR

meets your needs best?



AR Heavy-Duty Compressors

More air per horsepower than any comparable compressor! For continuous, full-load operation. "L" angle, 2-stage, double acting. Water cooled. Standard models provide 382 to 3210 cfm free-air delivery at 100 psi; only 76-590 hp required! (Can be supplied for other working pressures on request.)

What's your compressor requirement? Need an installation large enough to provide air for all your needs? Or would a small, compact unit for auxiliary operation solve your immediate problem? Either way—and for a wide range of applications between these extremes—Atlas Copco has the compressor for you!

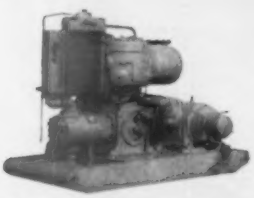
No matter which you choose, you'll get these proven advantages from Atlas Copco:

(1) More air per horsepower—less power consumption than other comparable units!

(2) Really low maintenance (one example—$310 after 10,000 hours' operation)!

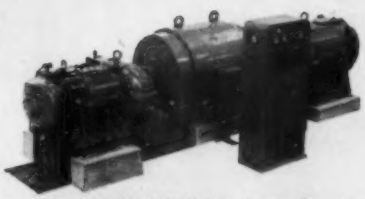
(3) Specifications are guaranteed free-air delivery—you get exactly what you order!

Get all the facts now—and compare! The coupon below will bring you a free catalog. (No obligation, of course.)



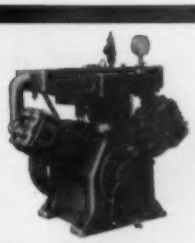
AR-L Heavy-Duty Compressors

Same basic construction as the AR Series, but provided with an air-cooled intercooler and air-cooled radiator for the cylinder water. Fan on compressor flywheel cools radiators. Perfect for arid areas or where difficult to bring in water. Both stationary and skid-mounted models available.



TWIN-AIR Rotary Screw Compressors

Brand new! "Twin-Air" Compressors offer capacities from 6,900 to 19,400 cfm at working pressures up to 115 psi. And, you get completely *oil-free* delivery of air or gas, since no lubrication is required — timing gears maintain small clearances between precision-mounted rotors, eliminating friction (and the necessity of oil) in compression chamber.



CT Air-Cooled Compressors

Stationary, or skid-mounted compressors for use where air demand is between 50 and 300 cfm. Totally air-cooled. Cylinder arrangement designed for smooth, vibration-free operation. Compact, rugged—for continuous, 24-hour trouble-free service. Highly efficient; low on maintenance costs.

FREE!

Write today for your free copy of our short-form catalog, describing the line of Atlas Copco stationary compressors. Ask, too, for detailed information on the model you need most. Use the handy coupon at right.

ATLAS COPCO
Dept. F-4, 545 Fifth Avenue,
New York 17, N.Y.

Gentlemen:
Please send me ☐ Short-form catalog ☐ Detailed information on the_____Series

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Atlas Copco

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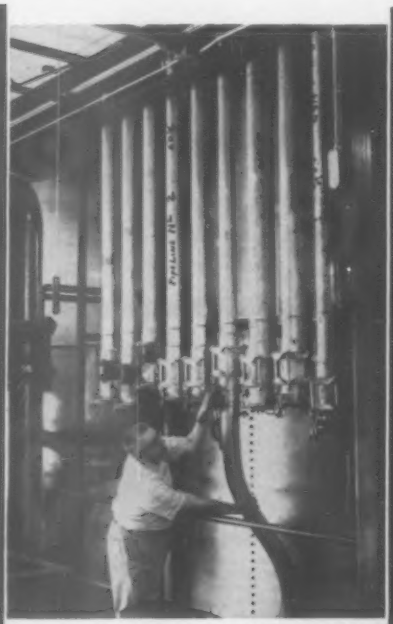
D. M. Nutter, Vice President in charge of production at Chippewa Plastics Company, Chippewa Falls, Wisconsin, reports:

"Airstream conveying pays the rent on our new plant"

"Savings in labor and materials costs make this possible. Our Dracco Airstream Conveyor System replaces hand-loading methods used in our former plant. Now we move from raw materials to finished product . . . without manual handling. Here's how:"

"Bulk polyethylene for our film producing process is unloaded quickly, cleanly, smoothly. Once turned on, the system requires only part-time attention of one man."



"The suction-pressure system draws material to the Airstream Receiver, then blows it into any of 12 storage silo inlets. Conveying air is thoroughly filtered to prevent contamination. The quick-disconnect hose is easily switched from one inlet to another."

"Out-of-the-way conveying lines distribute different polyethylene resins to storage. The system handles a million pounds of material a month. It's been foolproof, maintenance-free, easy to operate. We believe it shows the way materials handling is going."

Growing industries, like plastics processing, are quick to pick up better ways of doing things. As you move ahead on progressive programs, consider air conveying for your bulk materials. Call on Dracco to help.

DRACCO DIVISION OF FULLER CO.
4080 East 116th Street • Cleveland 5, Ohio

DRACCO *airstream* conveyors
dust control equipment

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For more facts Circle 405 on Reader Service Card ➤

compare

TORQUE · PERFORMANCE · DEPENDABILITY

BUY A... SIOUX

AIR or ELECTRIC

IMPACT WRENCH

Air impact wrenches deliver

up to 15% more torque

while consuming 30% less air!

Superiority of their mechanical design is revealed in the unusual efficiency of SIOUX Air Impact Wrenches. Wrench for wrench, model for model, size for size, SIOUX can be counted upon to deliver an average of 15% more torque, while consuming 30% less air! Less power is absorbed by the wrench itself. More is applied to the drive. Three SIOUX wrenches can be operated on the existing air supply for every two of another kind. This correctness of engineering design has also produced a wrench of superior endurance, longevity, and freedom from trouble. Low first cost, higher torque, lower air consumption and long trouble-free life add up to make SIOUX THE BIG BUY IN AIR IMPACT WRENCHES!

No guess work with . . . . CERTIFIED SIOUX POWER

When it's a SIOUX, you know what it will do! SIOUX tells you the torque your air or electric impact wrench will deliver. You don't buy just a wrench. You buy certified SIOUX power, reversible power, and on air wrenches controllable power through eight point power selector.

REACTION BALANCED for Less Vibration Feed Back

All SIOUX Impact Wrenches are "reaction balanced" for less vibration and torque feedback and for minimum operator fatigue. There's less shock and twist when the wrench impacts. You can feel the difference!

A SIZE FOR EVERY NEED!

From the big No. 322 SIOUX Air Impact Wrench (upper left) capable of up to 1,000 foot pounds of torque at 90 pounds of air pressure, to the little No. 313 (pictured at right) which weighs 2½ pounds and can deliver up to 80 foot pounds of torque, there's a full range of SIOUX impact wrench sizes and models.

SIOUX *Electric* **IMPACT WRENCHES**

SIOUX Electric Impact Wrenches offer equal power in right or left hand rotation. The torque for each wrench is stated and certified. Their mechanical design offers exactly the same advantages as that of the air wrenches. Their exclusive reverse cap switch lock prevents reversing with the current on, and eliminates burning commutator brushes and switch contacts. Their efficiency, performance, and freedom from trouble are unexcelled.

Look under **"TOOLS, ELECTRIC"** *in the Yellow Pages*

ALBERTSON & CO., INC.

SIOUX CITY, IOWA • U.S.A.

AIR IMPACT WRENCHES • AIR SCREWDRIVERS • ELECTRIC IMPACT WRENCHES • ELECTRIC SCREWDRIVERS • DRILLS • GRINDERS • SANDERS • POLISHERS • FLEXIBLE SHAFTS • PORTABLE SAWS • VALVE GRINDING MACHINES • ABRASIVE DISCS

FOR SURE, SCIENTIFIC PROTECTION AGAINST INDUSTRIAL SKIN HAZARDS, SAFETY ENGINEERS SPECIFY

"KERODEX"

BARRIER CREAM

THE MIRACLE SECOND SKIN OF INDUSTRY

Thousands of users in every field of industry! A powerful shield against hundreds of industrial irritants!

"Kerodex" spreads like a cream; acts like an invisible glove. Won't smear, and won't affect — or be affected by — materials handled.

"KERODEX" 51 FOR DRY WORK

Protects against liquid and solid irritants not soluble in water. When washed off, expansion action provides "lift" that pushes particles and irritants away from the skin.

"KERODEX" 71 FOR WET WORK

Protects against water and water-soluble irritants. Hands may be washed while wearing Kerodex 71 because this cream does not wash off but gradually wears off.

NEW USES FOR "KERODEX" ARE DISCOVERED BY WORKERS, PLANT MANAGERS, ENGINEERS . . . ALMOST EVERY DAY!

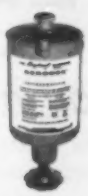
Protects against acids, solvents, paints, cutting oils, resin. Write for literature.

EASY TO APPLY!

Just spread "Kerodex" lightly and evenly, rubbing hands together until cream is absorbed by the skin. Spread around wrists, between fingers, into the cuticles and under the nails. For heavy work, apply second coat in the same way.

Please use coupon or specify in-plant testing offer on purchase order

Protect your company against costly insurance claims, extensive sick leaves, production delays!



FREE! CONVENIENT BRIGHTWELL WALL-DISPENSER

SPECIAL IN-PLANT TESTING OFFERS F20

EXPIRES APRIL 30, 1960

AYERST LABORATORIES
22 East 40th Street • New York 16, N.Y.

☐ 1 dozen 1/4-lb. tubes "Kerodex" 51 for dry work at $10 per dozen
☐ 1 dozen 1/4-lb. tubes "Kerodex" 71 for wet work at $10 per dozen

FOR MORE EXTENSIVE TESTS IN DEPTH — A MONEY-SAVING OFFER

☐ 6 1-lb. tins "Kerodex" 51 for dry work *and* 6 1-lb. tins "Kerodex" 71 for wet work. Both for $25.00

A $12.50 VALUE — FREE! A BRIGHTWELL WALL-DISPENSER WITH EVERY 32 LBS. ORDERED! DISPENSES INDIVIDUAL APPLICATIONS

☐ 4 8-lb. tins "Kerodex" 51 for dry work at $67.20
☐ 4 8-lb. tins "Kerodex" 71 for wet work at $67.20

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STREET ADDRESS.....
CITY.....ZONE.....STATE.....
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QUICK DELIVERY FROM ONE OF OUR CONVENIENTLY-LOCATED WAREHOUSES! 6002

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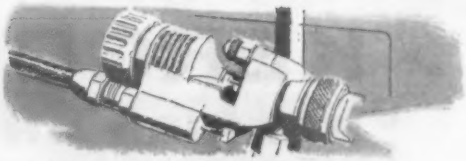
The one sure way of getting

for your products 

that offers the entire package:

for equipment (2) an unbiased

the method best suited to your

research, engineering,

Three words say it:

DeVilbiss

Put it to work for you now!

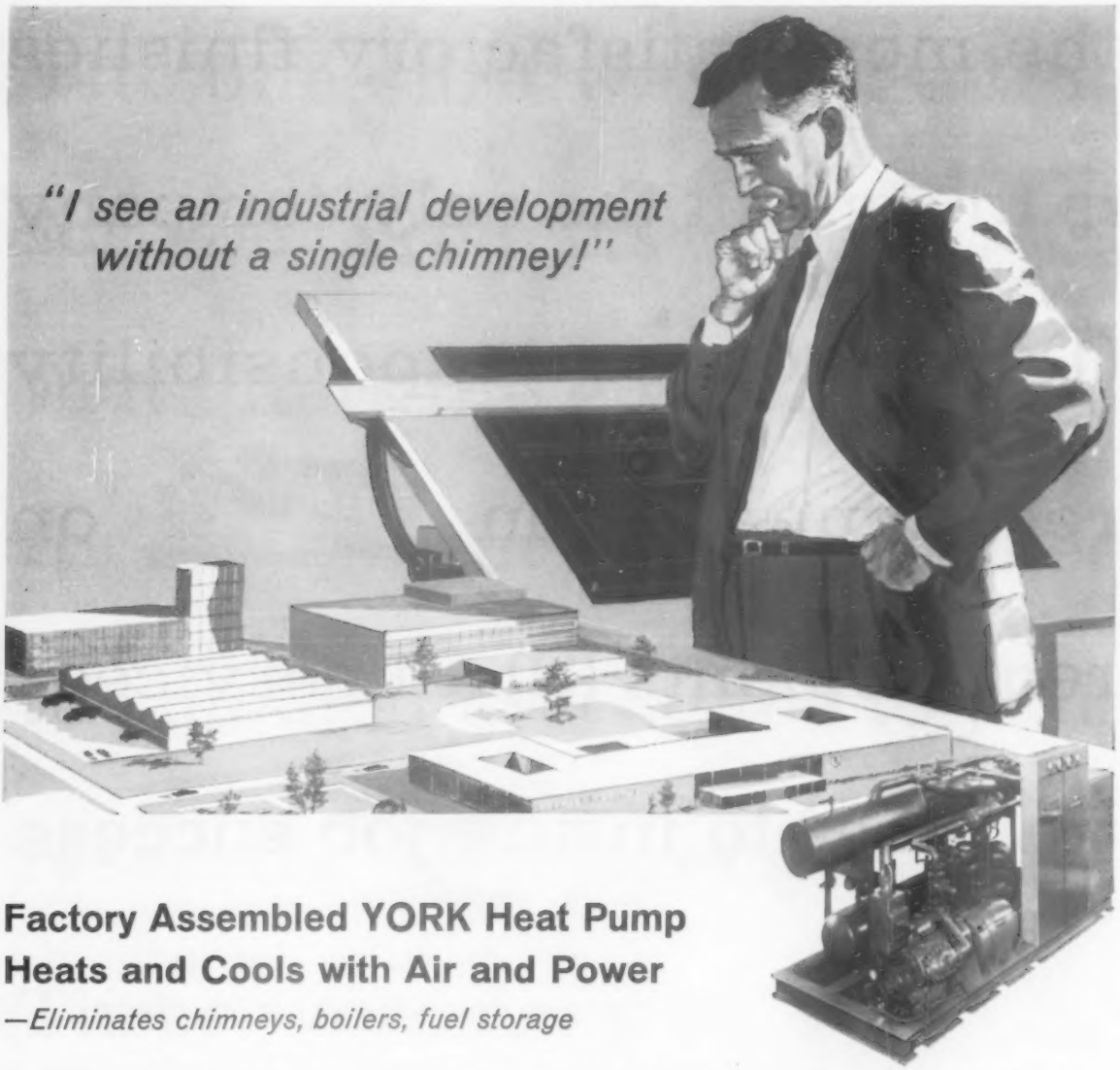
the most satisfactory finishes is to consult the only company (1) one-source responsibility recommendation on requirements (3) all services--training--to insure job success.

total service

Spray guns Automatic spray coaters Dip coaters Flow coaters Hot-spray systems Airless spray equipment Portable spray outfits Air compressors Hose and connections Paint tanks and pumps Circulating systems Spray booths Paint baking ovens Moisture dryers Foundry ovens Make-up air systems Power spray washers Rustproofing machines Pickling equipment Dust collectors Oven heaters Engineered finishing systems Customer research laboratories World-wide parts and repair service Complete operator training

FOR TOTAL SERVICE, CALL DEVILBISS

THE DeVILBISS COMPANY, TOLEDO 1, OHIO. ALSO BARRIE, ONTARIO; LONDON, ENGLAND; SÃO PAULO, BRAZIL. OFFICES IN PRINCIPAL CITIES.



Factory Assembled YORK Heat Pump Heats and Cools with Air and Power

—Eliminates chimneys, boilers, fuel storage

EXCLUSIVE COMPOUND COMPRESSION—Patented multi-stage compression wrings heat from even – 10° F. air making York Heat Pumps practical in coldest climates. Compound compression delivers up to 67% more heat than single-stage system from same power.

REDUCES COSTS, SAVES SPACE—No unsightly chimney to build and maintain, no boilers to tend, no space-wasting fuel storage, no smoke and soot. Compact system can be located anywhere from basement to roof, or even in separate building.

NO SUPPLEMENTARY HEATING—Compound compression eliminates need for electric strip heating, reduces operating costs. York Heat Pumps can heat and cool simultaneously, or automatically switch from one to the other according to load.

SIMPLIFIED SELECTION AND INSTALLATION—Can be completely factory assembled to save design time and field labor. Units from 50 to 150 tons cooling and up to 1,200 MBH heating. Larger, field-assembled systems to meet your requirements.

Another YORK Trail Blazer Concept Proved in Action at *Sylvania Laboratory, Amherst, N. Y.*—A York Heat Pump provides all-weather air conditioning for this 85,000 sq. ft., 2½ story research and testing facility. System delivers 250 tons cooling and 2400 MBH heating to York perimeter fan-coil units.

YORK

YORK CORP., SUBSIDIARY OF BORG-WARNER CORP., 4702 GRANTLEY RD., YORK, PENNSYLVANIA

YORK B-W DIVISION

BORG-WARNER RESEARCH & ENGINEERING MAKE IT BETTER

Air Conditioning, Heating, Refrigeration and Ice-Making Equipment • Products for Home, Commercial and Industrial Applications

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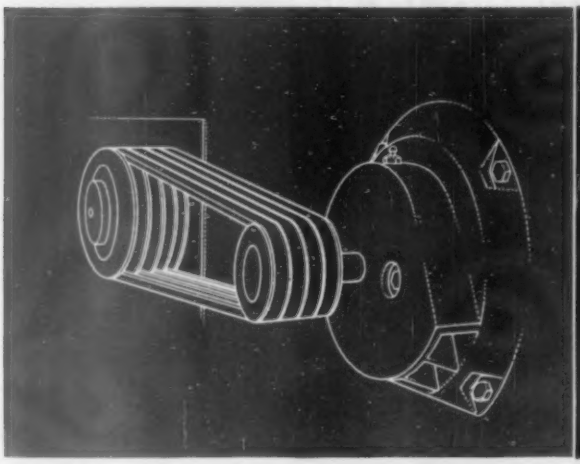
BEFORE: This drawing of the former 4-belt drive on a clothes pressing unit is in the same scale as the photo of new Super HC V-Belt Drive at right. Heavy sheaves needed for 4 belts imposed high bearing loads.

AFTER: By redesigning the drive for Gates Super HC V-Belts only 3 belts are required and this Utah manufacturer saves 16 pounds in weight and 24% on the drive cost of every pressing unit it makes.



Manufacturer of pressing equipment cuts cost of drives 24%

New high capacity V-belt also saves weight and space!

This manufacturer is just one of many who have already turned to Gates Super HC V-Belts to achieve far more compact, lighter weight, lower cost V-belt drives for all types of machines. With new Super HC V-Belts, sheave dimensions can be reduced 30% to 50%, overall space up to 50%, and drive weight by 20% and more.

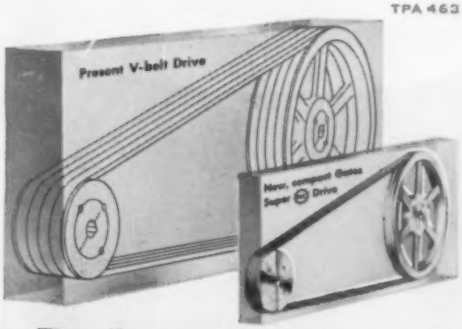
A product of Specialized Research in the world's largest V-belt laboratories at Gates, the Super HC V-Belt Drive is already standard equipment on production models in virtually every industry.

Engineering Service Nation-Wide

Whatever your plant's power transmission design problem, wherever you are, your nearby Gates Distributor or Field Representative is ready to assist you to cut space, weight, and costs with Super HC. Ask him for a copy of *"The Modern Way to Design Multiple V-Belt Drives."*

TPA 463

The Gates Rubber Company, Denver, Colorado
Gates Rubber of Canada Ltd., Brantford, Ontario



Gates *World's Largest Maker of V-Belts*

Gates Super HC V-Belt Drives

same hp capacity in smaller "package"

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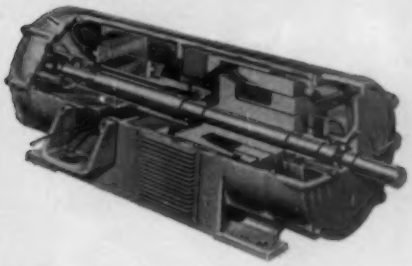
What do you need in an
adjustable speed drive?
Better Regulation!
Compactness!
Less Maintenance!

7½-hp Ajusto-Spede Drive



Common motor-drive housing for units up to 7½ hp saves space — can be foot or flange mounted. Larger sizes up to 100 hp with individual motor and drive housings mounted integrally.

NEW design news from Louis Allis

...The Louis Allis AJUSTO-SPEDE® drive is more compact, precise, and trouble-free

Here's an adjustable speed drive that allows *truly precise* machine operation. Speed regulation is automatic and stepless — results in faster, more efficient production at lower cost, with less waste, and minimum wear on equipment.

These and other benefits are yours when you use the improved Louis Allis Ajusto-Spede drive. For example, it can be set before or during operation to deliver any desired speed within its range. Its *exclusive* tachometer feedback circuit monitors the output speed and *automatically corrects speed and holds it* regardless of load changes.

This improved drive requires minimum maintenance. Its stationary field has no brushes, commutators, or slip rings to cause trouble. The source of power is an equally trouble-free standard a-c squirrel cage motor. The cast-iron housing keeps out dirt, chips, and moisture — resists corrosion.

The compact Ajusto-Spede also saves space. Integrally-mounted motor and drive simplify handling — can be easily adapted for installation on new or existing machines. Controls can be mounted at the machine or any other convenient position.

The Louis Allis Ajusto-Spede drive is the practical solution to almost every application that requires dependable, easily controlled adjustable speed. It is the answer to precise operating speeds for machine tools, process machinery, test equipment, windups, conveyors, printing presses, and other equipment. Contact your Louis Allis District Office for information and application help. Or write for bulletins 2750 and 2800 — The Louis Allis Co., 432 East Stewart Street, Milwaukee 1, Wisconsin.

® Ajusto-Spede is a registered trademark of the Eaton Mfg. Co.

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

LOUIS ALLIS

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ASD-127

A beauty of a buy!
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New High Styled Heavy-Duty
BLACK & DECKER VACUUM CLEANERS

Black & Decker Heavy Duty Vacuum Cleaners designed to suit your every need

Take the new No. 25 Heavy-Duty, for example. Here's *whisper-quiet* cleaning in a new concept of industrial vacuuming. The 25's swivel top permits cleaning a 15′ circle without moving the vacuum. And when the job's done just throw away the disposable bag! With power to spare the No. 25 is the most compact heavy-duty vacuum on the market.

Other models, ideal for general office, factory and furnace room use, are the No. 35 (¼ bushel capacity); No. 65 for wet and dry cleaning; No. 95 for extra capacity and power. No. 55 for super capacity (50 gallons); and No. 648, designed for efficient furnace cleaning.

Whatever your cleaning needs call on B&D power, capacity, quietness. See the line soon. Mail coupon for free demonstration.

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☐ Please send additional information on _____

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Company _____

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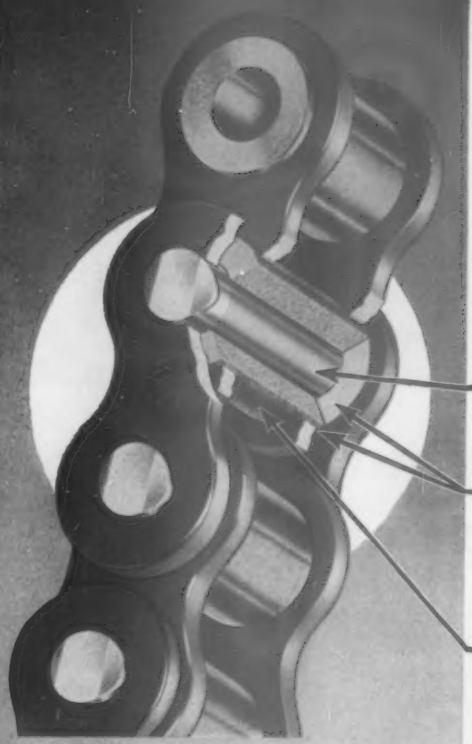
☐ Drills ☐ Saws ☐ Scrugun® ☐ Belt Sanders

WHITNEY MSL* CHAIN PROVIDES COMPLETE

BUILT-IN LUBRICATION

AT ALL 3 CRITICAL AREAS



Whitney MSL Chain is lubricated for life by oil-impregnated, sintered steel bushings—an exclusive development of Whitney Research. With this development, Whitney solves a basic chain problem . . **more damage is caused by faulty chain lubrication than by years of normal service.** Pressure and heat cause built-in lubricant to expand and flow from bushings, providing a constant supply of lubricant to every working part of the chain. When drive stops, bushings re-absorb oil, ensuring a permanent oil supply for the life of the chain. By solving the lubrication problem, and because of other important design advantages, Whitney MSL Chain outlasts conventional chain as much as 5 to 1 in severe operating environments.

Critical Area 1

PIN—Protective film of oil completely lubricates the live bearing area between pin and bushing, minimizing wear by reducing metal-to-metal contact.

Critical Area 2

PLATES—Whitney oil-impregnated sintered steel bushings extend beyond surface of inside plates to: act as lubricated thrust bearings, control clearance, and provide an oil cushion between plates, eliminating plate galling and seizing frequently caused by misalignment of sprockets.

Critical Area 3

SPROCKET ENGAGEMENT—Oil film on exterior surface of Whitney MSL Sintered Steel Bushings provides constant lubrication between sprocket teeth and chain. Whitney MSL Chain requires no rollers, as the tough oil film on the bushing surface provides smooth sprocket engagement, cushions impact and reduces drive wear.

Whitney oil-impregnated bushings—developed through continuous Whitney Research—are produced exclusively by Whitney to assure MSL Chain users of highest quality and reliability.

Inherent material characteristics of Whitney Sintered Steel Bushings, plus bushing configuration that provides greater contact area between bushings and links, permit high interference fit, which pre-loads links and gives maximum fatigue resistance.

Controlled clearance between plates promotes self-cleaning action.

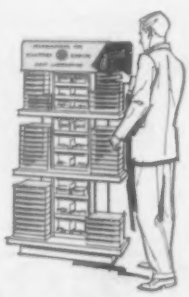
WHITNEY MSL CHAINS MEET ASA STANDARDS

All essential dimensions of Whitney Standard and Extended Pitch MSL Chain conform fully to ASA Standards, making it completely interchangeable with any similar pitch ASA standard chain, simplifying specification for new equipment, or as a replacement for existing drives.

Whitney MSL Chain is carried in stock by Distributors in all parts of the United States, for prompt delivery.

* **Maximum Service Life**

MSL Chain is carried IN STOCK by your Whitney Distributor. Ask him to show you how and why Whitney MSL Chain gives you more chain drive value per dollar.



THE WHITNEY CHAIN COMPANY

a subsidiary of **FOOTE BROS. GEAR AND MACHINE CORPORATION**

4585 S. Western Blvd., Chicago 9, Ill.

POWER TRANSMISSION DRIVES

For more facts Circle 412 on Reader Service Card

Work with your AIM*. . . National Carbon Company does . . .

Heavy-duty steel strapping unitizes electrodes

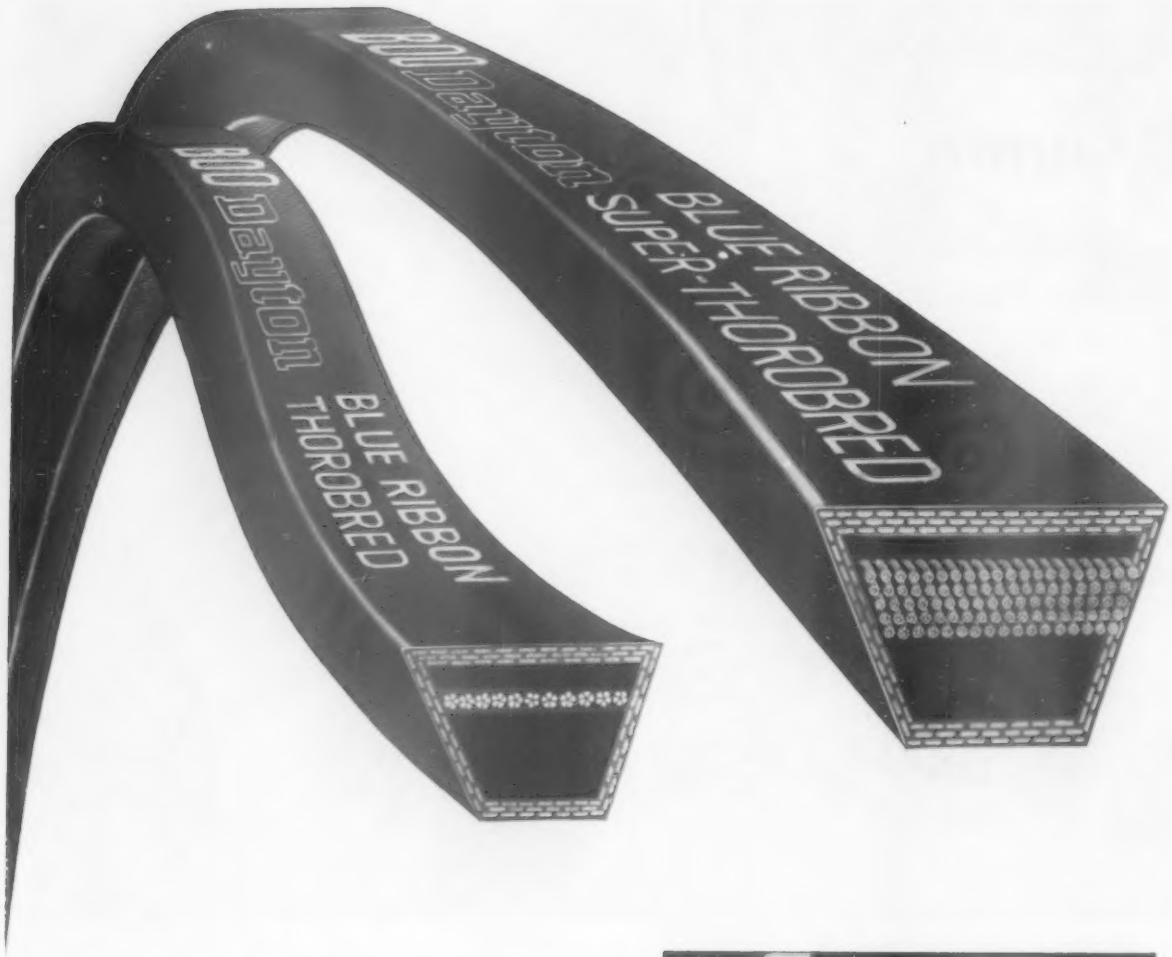
Acme Idea Man Dick Bush worked with National Carbon Company on this strapping station technique.

NATIONAL CARBON COMPANY, DIVISION OF UNION CARBIDE CORPORATION, NIAGARA FALLS, NEW YORK, worked with their Acme Idea Man to develop a better technique for unitizing graphite electrodes. An Acme Steel Pneumatic Stretcher is used to strap electrodes with less time and material than ever before. (Idea No. U6-34)

The compact B1R10 Pneumatic Stretcher uses heavy-duty steel strapping directly from the coil. Electric strap dispensers and pneumatic power make strapping easier, and air pressure can be set to deliver the same uniform tension on every strap applied. The Acme Steel C8 Pneumatic Sealer is the ideal companion to the B1R10 Stretcher.

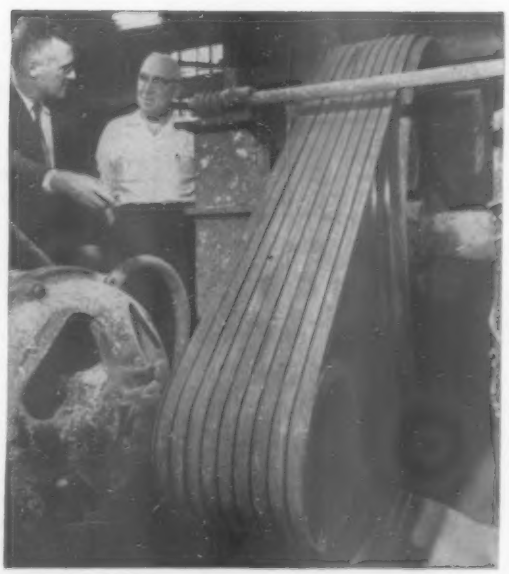
***Work with your Acme Idea Man.** He'll provide you with additional information on the B1R10 Pneumatic Stretcher. Ask for a demonstration on your products. Call him or write Dept. FAU-20, Acme Steel Products Division, Acme Steel Company, Chicago 27, Illinois. In Canada, Acme Steel Company of Canada, Limited, 743 Warden Avenue, Toronto 13, Ontario.

ACME STEEL **STEEL STRAPPING**



- **Extreme Length Stability**
- **Eliminates Matching Problems**
- **Controlled Elasticity**
- **Greatest Over-All Strength**
- **New Super Strength Cords**
- **Oil and Heat Resistant***
- **Static Dissipating***

***Super-Thorobred V-Belts**



DAYTON BLUE RIBBON SUPER-THOROBREDS save $13,000 a year in maintenance and lost production time on this pulp beater. With Dayton belts installed these beaters have operated on a continuous 24-hour schedule for well over 2 years with not one moment of downtime due to V-Belt failure.

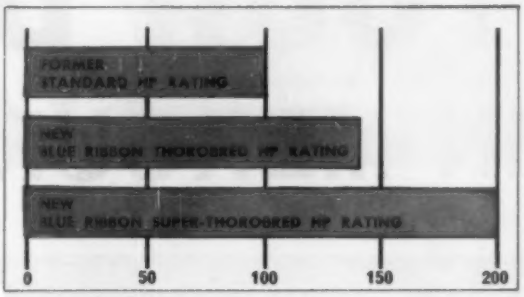
The leader in V-Belt development announces a complete ***NEW*** *line—*

Dayton BLUE RIBBON V-Belts

with important new gains in ***Thorobred*** *and* ***Super-Thorobred*** *horsepower capacity*

When you have to increase production, reduce downtime and cut costs all at the same time, the new name to remember in V-Belts is Dayton **Blue Ribbon** . . . not a redesigned V-Belt line, but a completely new approach to power transmission that only Dayton V-Belt engineers could produce.

Everything's new—from the selection of rubber stocks in the compression and tension sections to the "controllable" synthetic fibres in the strength section and the double-wrapped "High Twist" bias-cut cover that's applied relaxed for maximum give during bending. These exclusive new features give you the best all-around V-Belt line on the market today . . . at budget costs.

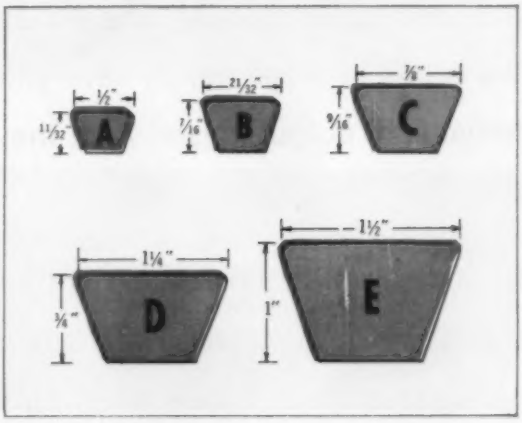


New Blue Ribbon Thorobred ratings are 40% higher than previous standard belt ratings.

New Blue Ribbon Super-Thorobred ratings are now 70% to 120% higher than previous standard belt ratings.

New Dayton *Blue Ribbon* V-Belts cut costs five ways:

1. **Prolong machine life.** Blue Ribbon Belts absorb machine killing shock loads and vibration . . . protect valuable production equipment.
2. **Reduce inventory.** Now, belts can be ordered singly or in perfectly matched sets by number alone. Each belt carries its share of the load for longer life and fewer replacements.
3. **Wider operating range.** Your present sheaves now offer a much greater range of horsepower capacities. No special sheaves required.
4. **Improved efficiency.** Blue Ribbon Belts operate at less tension, thereby increasing bearing life.
5. **Increase production.** Long Belt life means less downtime for replacement.



Blue Ribbon V-Belts are available in a full range of industry standard sizes.

Thorobred—A through E cross-section

Super-Thorobred—A through C cross-section

FOR MORE INFORMATION SEE YOUR YELLOW PAGES UNDER "BELTING" OR WRITE TO:

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INDUSTRIAL DEPARTMENT

Dayton Industrial Products Co.

Melrose Park, Ill.
A Division of The Dayton Rubber Co.

Please send me a free copy of the "Handbook of V-Belt Drive Design."

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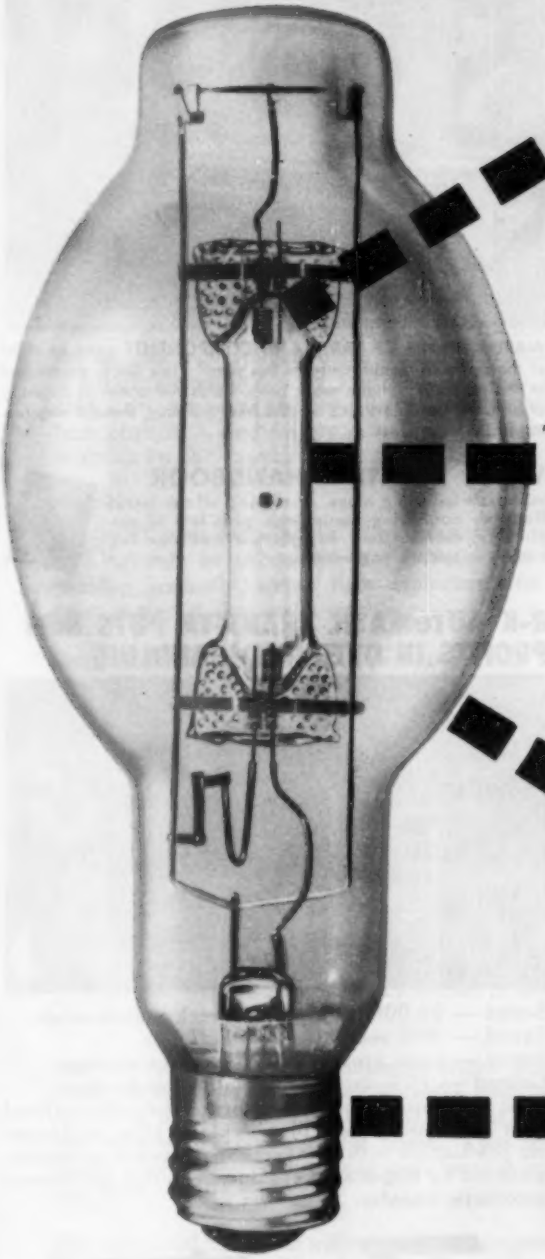
EXCLUSIVE WEATHER LIFEGUARD™ ARC TUBES

YOUR BEST BUY IN MERCURY LAMPS!

By any standard of comparison, new Westinghouse "Lifeguard" mercury lamps are the most economical choice for industrial, street, and parking lot lighting. The exclusive Westinghouse "Lifeguard" arc tubes in these lamps save you money by maintaining high initial light output longer. And, they make possible lower-cost new lighting installations.

In addition to getting more light per dollar, you save on labor and maintenance costs, too, with less frequent lamp changing. And "Lifeguard" lamps are made with famous Westinghouse "Weather Duty" bulb construction for resistance to thermal shock, moisture and all industrial fumes. New Westinghouse "Weather Duty" lamps with "Lifeguard" arc tubes are interchangeable with other types of the same wattage. Make the change today. Contact your authorized Westinghouse lamp agent or nearest Westinghouse sales office.

DUTY™ LAMPS WITH MAKE WESTINGHOUSE



New design electrodes with specially-compounded and locked-in emission material virtually eliminate light-robbing arc tube blackening.

"Lifeguard" arc tube improves lumen maintenance... 85 percent of initial light output after 10,000 hours.

First with "Weather Duty" lamps... fume-proof and moisture-proof, shock-resistant glass.

Permanent-grip silicone cement holds bases tight for the life of the lamp. Remains strong at high temperatures. No strain on glass.

YOU CAN BE SURE...IF IT'S Westinghouse

Westinghouse Lamp Division · Bloomfield, N. J.

RAPISTAN Ideas HANDLING

HOW MANY WAREHOUSES CAN YOU FIND IN YOUR PLANT?

Sometimes you can't see the warehouses for the machines. Most plants have no trouble identifying at least two areas where warehousing goes on. The first that come to mind are the receiving and shipping areas.

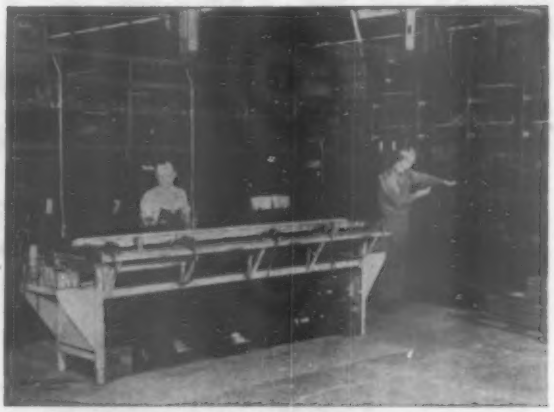
But how many unrecognized warehouses are you operating? It could be quite a few. When the flow of material through any plant is analyzed, build-ups of work are frequently found before and after each operation. These build-ups of material, in themselves, create warehousing problems. And, big or small, these "hidden" warehouses may be costing you more than you realize.

In almost every plant, these little warehouses are likely to be out of phase with where they should be, and how big they should be for maximum flow efficiency. Sometimes the most practical arrangement is a simple storage rack. Other times overhead storage on Rapistan-Keystone trolley conveyor is the answer. Sometimes greatest efficiency can be gained with a more complex live storage Flow Rack equipped with mechanical indexing and selection devices.

In any case, by streamlining and simplifying the operation of your hidden warehouses, you can gain better utilization of space and control of inventory first-in-first-out use of materials, cut down on spoilage and damage costs, and improve your entire handling pattern.

Rapistan engineers specialize in recognizing these less obvious areas, and developing modern storage conveyors for just such problems. They've developed some new concepts of "stop-and-go" storage that have brightened the profit picture for thousands of manufacturers, as well as for wholesalers and retailers. If the "hidden warehouse" in your plant is not as efficient as the rest of your operations, or if you just suspect that it isn't, call on your Rapistan engineer.

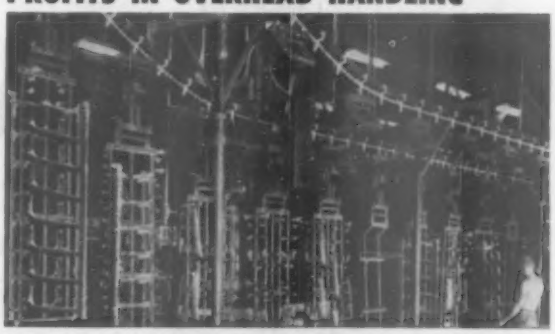
RAPISTAN FLOW RACK IS THE HEART of this mechanized selection system used in the shipping department of one of the world's largest record manufacturing plants. A remote-controlled belt conveyor takes cartons from any hatch in the rack, conveys them to a checking station en route to the shipping dock.



WAREHOUSING OF PARTS AND COMPONENTS goes on right at the point of manufacture in this plant. Flow Rack, positioned at the perimeter of the work area, holds the optimum quantity of all parts used here. It's loaded from the rear, without interfering with production.

WRITE FOR THIS HANDBOOK of materials handling ideas, describing all the latest Rapistan conveying equipment, plus lots of application information, suggestions and tips for conveyor system engineering.

R-K AUTOMATIC TRANSFER PUTS NEW PROFITS IN OVERHEAD HANDLING



Saved — $6,000.00 a year on rack maintenance.
Saved — 40% reduction in direct labor.
Saved — large area formerly used for storage.
Gained — 70% increase in plating production.
That's the profit-boosting record of benefits realized by a large midwestern plating plant, after modernizing production with an overhead conveyor system engineered by Rapistan-Keystone, featuring an unusual automatic transfer.

Rapistan®
CONVEYING EQUIPMENT
The RAPIDS-STANDARD CO., Inc.
690 Rapistan Building, Grand Rapids 2, Michigan

FACTORY PRESS TIME REPORT • FEBRUARY 1960

Looking Ahead in Business

You can find many reasons for optimism about the business outlook for the coming months. Not the least important is the way industrial production bounced back when the strike-worn steelworkers returned to their jobs.

As measured by the FRB production index, December output hit 165 (1947-1949 = 100), up 11 points from the low during the strike, and just 1 point below the all-time high set before the strike. (The index is now being calculated on a revised base that includes the output of utilities, so the numbers have been changed.) And further gains in output are in prospect for the months ahead.

•

But don't look for a boom. The gains you'll see will certainly be substantial; but business will be growing gradually, rather than exploding with a great clatter of ticker-tape machines.

One reason: Consumers don't appear to be ready for a buying binge just yet. The survey of consumer attitudes completed last November by the University of Michigan Research Center indicated that the consumer buying attitude had taken a turn for the worse in the latter months of 1959. Many consumers felt that then was a bad time to buy. And when this attitude prevails, consumers usually hold off on some of their purchases.

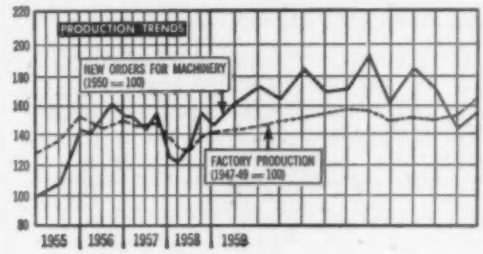
It is not, however, an indication that sales will slump as the months progress into mid-1960. The big cause of pessimism among consumers late last year was the steel strike. But that's behind us now.

•

The long-range outlook of consumers is bright. Practically all those surveyed in the Michigan study expect to be better off financially at the close of 1960 than they were when last year ended. Thus they should be in a better buying mood as we move deeper into 1960.

One substantial factor that will be working to brighten consumer attitudes is rising personal income. On a seasonally adjusted annual basis, total personal income climbed to $391-billion for December—up by almost $8-billion since October, the month that saw the end of the steel strike.

FACTORY FIGURES OF THE MONTH



Indicator	Dec. 1959[P]	Nov. 1959[r]	Dec. 1958
New Orders for Machinery (exc. elec.)[1]	157.9	143.9	140.3
Contracts for Industrial Construction[2]	139.7	153.6	80.4
Factory Production[3]	164.0	154.0	149.0
Consumers' Prices (cost of living)[4]	125.5	125.6	123.9
Industrial Prices (materials, supplies)[4]	128.6	128.5	127.2
Manufacturing Employment (millions)[4]	16.5	16.2	15.7
Total Employment (millions)[5]	65.7	65.6	64.0
Unemployment (millions)[5]	3.6	3.7	4.1

[P] = preliminary [r] = revised

Sources: 1. McGraw-Hill Department of Economics (1950 = 100); 2. Engineering News-Record (1950 = 100); 3. U. S. Federal Reserve Board (1947-49 = 100); 4. U. S. Department of Labor, Bureau of Labor Statistics (1947-49 = 100); 5. U. S. Department of Labor, Bureau of Labor Statistics.

For 1959 as a whole, personal income totaled $380-billion—a gain of about $21-billion for the year. Recent wage increase agreements are destined to boost incomes even further in the months ahead.

Installment credit rose to record highs during 1959. That may be another reason for consumer caution about buying. But the Michigan survey indicated that many consumers will be free from installment debt before the end of 1960. Conclusion: There's no reason to fear a buyers' strike during 1960.

Meanwhile, increased capital spending will be boosting business. Spending for new plants and equipment during the first three months of the year is figured at an annual rate of $34.4-billion. This is a gain of almost half a billion over the final quarter of last year, according to Commerce Department estimates. Further gains are forecast as we advance through 1960. And the President's estimate of a Gross National Product (GNP) of $510-billion for the year seems well within our reach.

62 Good Leads to File

THIS FILING SYSTEM is designed to give quick access to past FACTORY articles that can help you solve your current operating problems. Here's how it works:

1. All major articles (set here in bold type) and many short items are classified according to a functional code. Codes cover basic operating responsibilities.

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3. To use, cut up the items below. Paste them on 3x5-in. cards, file by code number. To cross-index, copy information on a second card, file by secondary code.

For ways to use your Problem-Solving Guide and an explanation of this Decimal Filing System, write Reader Service, FACTORY, 330 W. 42nd St., New York 36.

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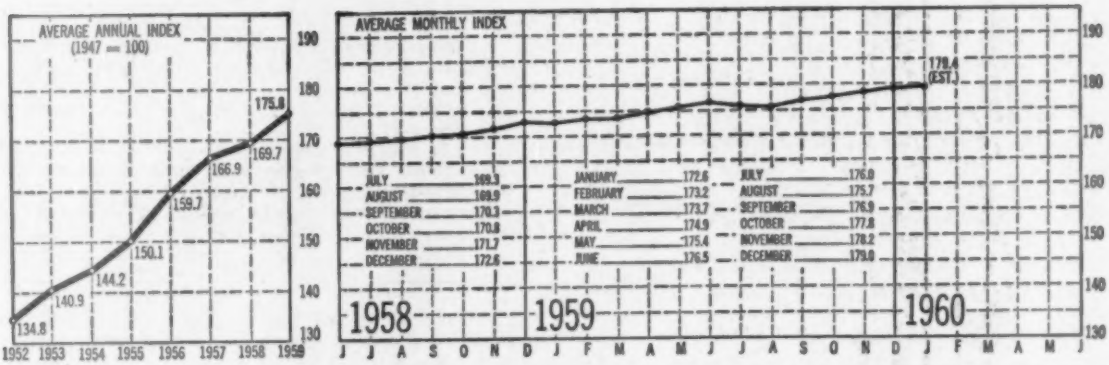
FACTORY PRESS TIME REPORT • FEBRUARY 1960

Cost Index of Plant Maintenance



1959 Closes Up 6.4%

December decline in price of materials is outweighed by rising labor costs.

Despite a last-minute decline in materials costs, FACTORY's Cost Index of Plant Maintenance climbed by 0.8 of a point to 179 in the month of December. This figure, in turn, sent 1959 costs up an average of 0.5% per month—a total increase of 6.4%. December was 0.3% above the average monthly cost increase.

The cost of labor in all manufacturing for December jumped up by 2.5%. Machine tool labor was up 0.4%. The two pushed up total labor costs in the equipment category by 1.6%. Labor costs for carpenters, electricians, and painters continued the upward trend they exhibited throughout 1959. As a group they added 0.2 of a point to over-all labor costs in the building and facilities category.

Materials costs in both categories of FACTORY's Cost Index declined in December. However, these declines represent a return toward normal for the prices of metal products (which were in short supply during the steel and copper strikes), rather than the beginning of a downward trend for materials prices. The price of nuts and bolts dropped 4.4 points and of solder, 3 points. But prices of copper items are still at the levels they reached in November. The cross-currents affecting the prices of nonferrous metals and alloys will persist through January as once-choked supply channels begin to flow normally again.

The 1959 rise of 6.4% in the Cost Index was the biggest since 1956 when it soared to 7.2%. Composite costs in 1960 are expected to rise by approximately the same amount. But this will depend on possible price changes for primary metals.

	AVERAGE 1959	DEC. (Preliminary)	NOV. (Revised)
Building and Facilities Index	166.5	168.5	168.7
Materials	142.3	141.6	142.7
Brick	152.5	153.0	153.0
Elec. Fixtures	129.0	131.6	131.6
Elec. switches, boards, fuses	185.6	187.6	187.6
Elec. wire, copper	138.9	148.6	148.6
Glass	152.0	152.0	152.0
Gutters, spouts, ducts	178.0	180.2	180.2
Gypsum products	140.8	140.8	140.8
Heating equipment	127.7	127.6	127.5
Lumber	134.5	133.2	133.2
Millwork	155.7	158.0	158.2
Paint	130.1	130.1	130.1
Pipe, cast iron	170.4	170.4	170.4
Pipe, steel	190.9	192.6	192.6
Pipe & tubing, copper	154.1	161.0	161.0
Roofing	123.7	120.7	120.7
Sanitary fixtures	155.6	161.8	159.8
Sash, metal frame trim	140.9	139.0	139.0
Solder	124.1	121.2	124.2
Steel, structural	236.3	236.2	236.2
Tanks, steel	138.0	139.7	139.5
Valves & fittings	166.7	171.1	171.1
Wire mesh	162.6	162.9	162.9
Labor	182.6	186.5	185.3
Carpenters	168.9	172.5	172.5
Electricians	191.1	194.9	194.4
Painters	187.9	192.5	192.0
Equipment Index	179.5	183.5	182.2
Materials	176.1	178.6	179.2
Abrasives	161.0	157.9	157.9
Alloys, non-ferrous	125.4	125.2	127.5
Bars & plate, steel	227.1	227.2	227.2
Bearings	164.1	164.6	164.6
Belting	157.3	159.5	159.5
Bolts, nuts & screws	225.6	228.4	232.8
Chain	184.0	184.0	184.0
Controls (electrical)	185.6	187.6	187.6
Gear-reduction units	181.7	181.7	181.7
Hand tools, mechanics	198.2	198.3	198.3
Lubricants	124.1	125.7	125.7
Motors	147.3	146.3	146.3
Non-ferrous metals	129.0	134.1	135.0
Precision tools	156.6	157.8	157.5
Pumps	194.8	195.5	195.1
Tools, cutting	172.4	177.1	177.2
Valves & fittings	166.7	177.1	177.1
Labor	181.8	186.8	185.2
All mfg. labor	179.9	182.8	180.3
Machine tool labor	184.2	190.9	190.5
FACTORY'S COST INDEX	175.8	179.0	178.2

FACTORY PRESS TIME REPORT • FEBRUARY 1960

Looking Ahead in Labor

Union interests have a legislative "sleeper" before Congress that you should watch closely. It holds the clue to organized labor's prospects on Capitol Hill this session—and should reveal its influence in the national elections next November.

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The issue being promoted by leaders of the AFL-CIO is an attack on the secondary boycott ban against construction unions. Labor officials are anxious to avoid becoming bogged down in Taft-Hartley and Landrum-Griffin—the labor reform bill they battled unsuccessfully last session. They are realistic enough not to expect that the second session of the 86th Congress is going to do better by them than the first session did.

Labor leaders want to chip away at the Taft-Hartley armor for just one quick amendment. The change they seek would permit craft unions to picket construction projects. The practice is now banned where this kind of picketing against one subcontractor affects other builders on the same project who are not directly involved in the dispute.

This demand was dropped from last session's Landrum-Griffin reform bill, but legislative leaders promised to bring it up again this year. George Meany and other AFL-CIO leaders are determined to cash in on that promise. "We expect them to redeem the pledge," says strong-man Meany.

It isn't that easy. The labor chiefs are playing a dangerous legislative game, after losing the same type of battle in 1959. If Taft-Hartley is pried open, management groups are set to toss their own demands into the legislative hopper. In the wake of the steel strike, they want "labor monopolies" curbed —through present anti-trust laws and new national emergency strike restrictions. Looks as though the makings of another legislative war between labor and management may be in the wind.

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If the AFL-CIO succeeds in its Taft-Hartley strategy, it means labor will be a more potent political force this year. What's more significant, it means that congressional leaders are still respectful—despite a series of recent setbacks on Capitol Hill—of union power at the polls.

Specifically, a union victory over any section of Taft-Hartley will promote labor's prospects for winning welfare legislation this session—on hiking the minimum wage and so on. And it means labor will carry a bigger voice to the national political conventions and congressional campaigns.

The AFL-CIO political wing—the Committee on Political Education (COPE)—is quietly building for the coming political campaign. A new "state department" has been organized at its Washington headquarters to coordinate labor's political role in state legislatures and its strategy in the battle over "right-to-work" laws. Until this year, state labor groups have had no over-all leadership or guidance from AFL-CIO headquarters.

Political fund-raising sights are being raised. The collection goals for COPE, up to now, have been 20 cents a head from the AFL-CIO affiliated unions with a total 12-million membership. This is being raised to 25 cents. The great expectation: to climb over the $1-million mark for the first time.

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Attempts by craft unions to divorce themselves from production workers in industrial plants have been given a sharp blow by the U. S. Supreme Court. Under the ruling policy of the National Labor Relations Board, crafts have been able to set up their own bargaining units (1) whenever the employees within such a group constitute a true craft and (2) whenever the union seeking to represent them (traditionally) represents that type of craft.

This NLRB policy is now out the window. The high court recently refused to reverse a lower court ruling that the NLRB was "arbitrary and discriminatory" in its position. In the test case, the NLRB allowed electrical workers at the Cumberland, Md., plant of Pittsburgh Plate Glass to set up their own unit, peeling off from the established United Glass and Ceramic Workers Union. But the company refused to bargain with the electrical workers union—and the appeals court upheld this position. Says the NLRB: "This will have an unstabilizing effect on existing collective bargaining relations." Incidentally, the NLRB still permits units of engineers and other professional groups to hold their own separate unit elections, apart from the plant production workers.

SEE LABOR RELATIONS NEWS, PAGE 198

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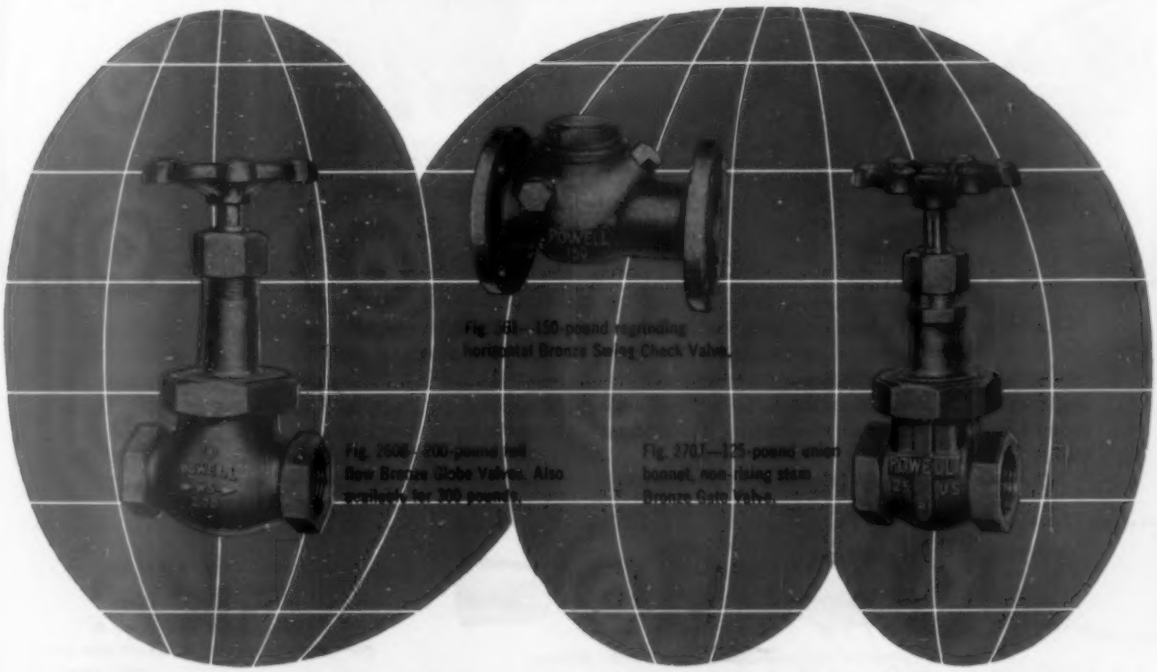

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FACTORY

Don't Cave in on Labor Costs

The steel strike has fizzled to a disappointing conclusion. Government pressures blocked any hope of resolving the key issue of work practices. Corporate management's cold determination to halt the eroding effects of wasteful plant practices has been diverted. The steel companies obtained only the weakest of concessions from the union—a joint committee to study changes in work rules. And their findings—not due until November 30—won't even be binding then.

So don't hold your breath hoping for Steel to set a pattern of labor cost reform that your company can follow. And don't expect your company to bloody its head where 11 steel companies failed. Get used to this idea again: *The hot potato of plant labor costs has been tossed right back into the hands of the men who manage plant operations.*

Now is not the time for you to cave in *your* resistance to labor wastes. Unfortunately, you can't shrug your shoulders at this issue. Keeping labor costs in line is a big part of the job you're hired to do. And in 1960 you'll have to dip even deeper into your bag of management tools to get the job done.

Start your efforts with this premise: *Failure to control labor waste is primarily a management failure.* Agreed that many unions, most employees, and a great many stockholders can share this blame. But in the long run, only plant management has the tools to cope with the problem.

Labor waste is caused by ignorance, by fear, by laziness. Both management and employees are often ignorant of what makes for good operations practice. Understandably, employees are fearful of their security: Management is fearful of rocking the boat, a quarrel, a temporary delay. But most of all, management is lazy. For it takes initiative, energy, and persistence to keep labor truly productive.

You can blitz ignorance with forceful work simplification and methods improvement programs. By accumulating—and acting upon—meaningful cost measures. By continually retraining your employees (see page 89 for real help in maintenance training). And by learning how to work out cost goals with the participation of your employees, your supervisors, and yes, even with your union.

You can help allay fear by building confidence, by demonstrating integrity, by better employee communications. By incorporating wage leveling periods in your cost reduction programs. By taking advantage of employment attrition in your automation plans. By assuming your share of responsibility in coping with changes that destroy men's jobs.

Finally, only you can overcome plant management's own inertia by regularly applying your own harsh judgment to stand-pat management complacency. And by acknowledging that the job of labor cost control is yours—all yours.

L. R. Bittel

EDITOR-IN-CHIEF

"I am convinced the U.S.A. is ahead of the Communists in management of the maintenance function. And because of free competition it will always be ahead."

The quote comes from Horst Grothus, West German plant manager. It's reassuring and encouraging. But don't feel too smug—because...

MAINTENANCE MANAGEMENT IS BIG BUSINESS - BEHIND The Iron Curtain

It's no secret that industrial progress in the Communist world is being pushed ahead at a furious pace. In fact, some Western authorities feel Red production of such basic commodities as steel will soon equal—or even surpass—our own.

One way the Communists can do this is to get optimum use out of existing plants and facilities. And this means they must concentrate on development of sharp maintenance management.

How are they doing in this critical area?

To answer this question FACTORY interviewed by mail Horst Grothus, plant manager, Ruberg and Renner (roller chain manufacturer), Hagen, Westphalia, West Germany. Grothus is well qualified to discuss East, versus, West maintenance management.

As a prisoner of war during World War II he worked in what was then the largest Russian tank factory—at Gorki. In 1951 he spent six months touring 45 U.S. plants. More recently he was invited to address an East German maintenance conference. This contact with *today's* top Red maintenance people added the last brick to the foundation of opinion reported in this article.

——THE GROTHUS REPORT——

Conformity is the key word in the Red organization. All Communist maintenance operations are practically alike. Maintenance departments have adequate funds and sufficient authority.

In a Communist country all industry is closely supervised by government authorities. The government plans the output of each plant, performs the different duties normally handled by a Western-style board of directors, works out all the management practices ordinarily set up by our middle management.

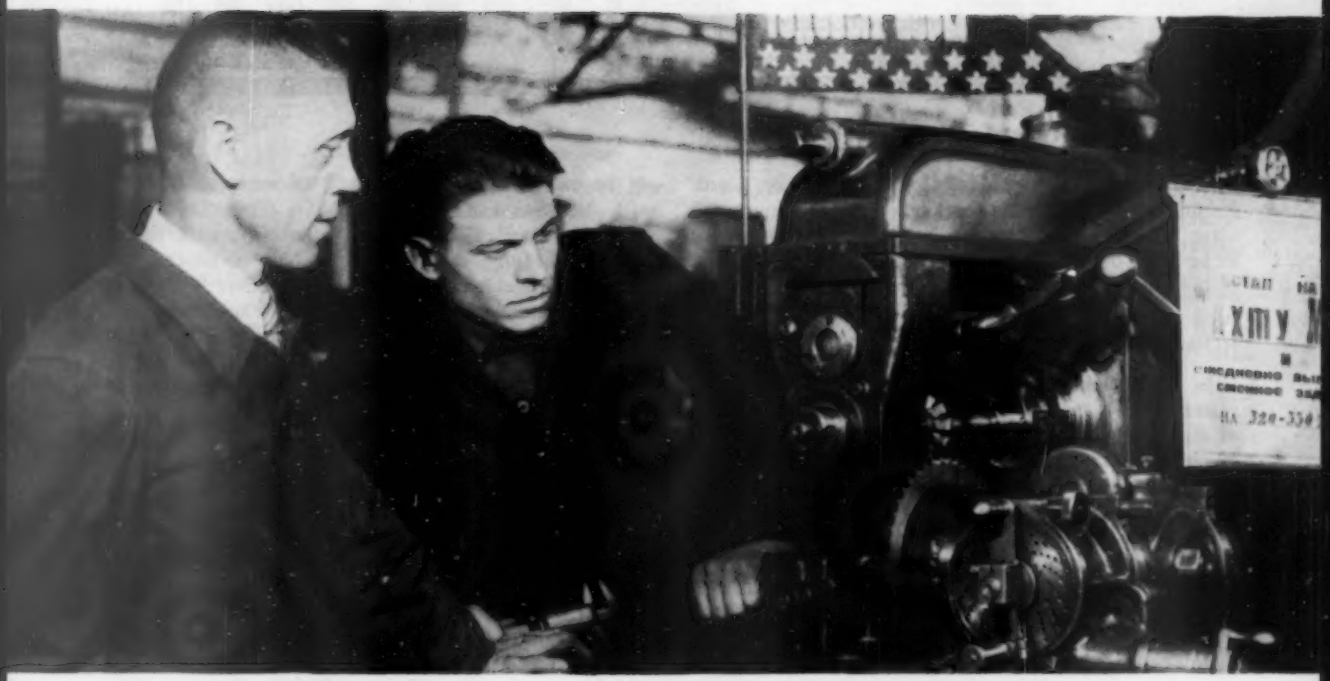
The management of maintenance has long been subject to considerable research in Russia. The experience Soviet ministries were able to gather is probably superior to any knowledge of any individual engineer or company in our part of the world. Since World War II the eastern European countries occupied by Russians have adopted many of their policies in plant maintenance. This has been particularly true of those plants actually owned by the Soviet government. Thus the practices now followed in eastern Europe and its literature on plant maintenance give a pretty good picture of what is going on inside the U.S.S.R. itself.

Typical organization—In the plants of the Communist bloc the master mechanic is in charge of all maintenance activities. His rank equals that of our production managers. He reports to top management. The organization chart in Fig. 1 (page 64) is the one officially recommended for the maintenance function itself. This set-up is uniform throughout the Red world. Each supervisory position is given the same responsibilities in plants countrywide.

Here's what the typical master mechanic must be and here are his official duties: He's a graduate engineer, with a proved capacity for job organization. He's had considerable maintenance experience. He must know the design and operation of all equipment in his plant. He must be familiar with over-all plant policies. He assists top management in planning new operations, designing better equipment, and plant relayout.

The master mechanic is responsible for keeping all equipment in satisfactory condition. He prepares all

A Sovfoto Photograph



Red in-plant research activities concentrate on preventive maintenance routines rather than on emergency repair methods.

instructions to maintenance and production workers for the operation and maintenance of equipment. He sets all maintenance schedules, supervises their execution. He directs the transportation and installation of all machinery. He plans repair operations, supervises all active maintenance work. He directs all planning and estimates labor and material costs. He's responsible for all maintenance inventories, including manufacture or purchase of spare parts and components.

In addition to these duties, this jack of all trades is responsible for worker safety, discipline in the maintenance shops, and shop cleanliness.

IVAN AND HIS RECORDS

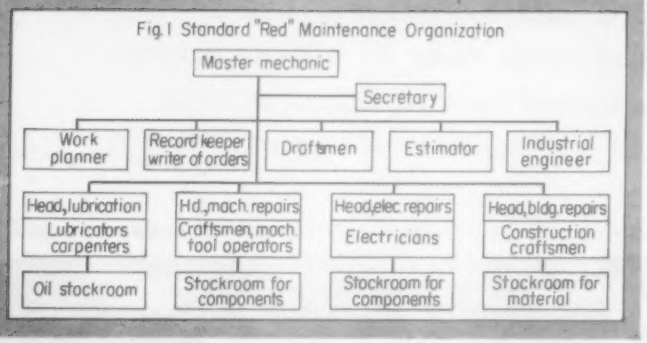
I have studied official East German machine-record forms. They're quite similar to those used and enforced in other Communist-bloc countries. They appear more detailed than anything I have seen in the West.

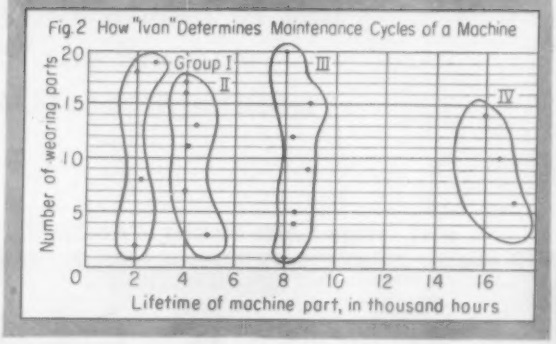
The Russians have realized the importance of thorough equipment records. Equipment suppliers are required to submit a complete set with the delivery of each piece of equipment.

The forms are printed on light index-quality cards of 8½x11-in. (standard letter) size. Each set comes in a folder imprinted on the front cover to show name of machine, serial numbers, location, make, purchase date, and other general descriptive data. This folder is labeled "Arbietsmittelpas" (equipment register) and holds at least 11 different forms:

1. Photo of machine; performance capabilities.
2. Basic dimensions, location, value, capacity, connecting services needed.
3. Replacement parts list, by name, number, supplier.
4. List of accessory tools or devices.
5. Capacity of machine under various conditions, machine features.
6. Transportation and handling instructions.
7. Foundation specifications.
8. Operating, service instructions (4-page digest).
9. Repair cost record on all maintenance jobs.
10. Overhaul cost record.
11. Lubrication schedule (folder).

These records are kept by the maintenance department and filed there. They are an excellent example of how extensively planning is being done in Communist countries. Cost of printing the forms, since they are uniform in these countries, is probably not much compared to





. . . The Iron Curtain

the benefits to the equipment user. On the other hand, I doubt that they care too much whether planning will serve the efficiency of the plant. Often planning seems to be done only for planning's sake, or for satisfaction of the planners.

HOW MUCH MAINTENANCE?

In several universities problems of maintenance are systematically studied. Laboratories test all new models of machine tools for frequency of replacement for all machine parts. From these results maintenance instructions are drawn up, which are supposed to be attached to every machine tool installed.

The Russians have realized that preventive maintenance is *the* way to efficient plant operation. Most research activities have therefore concentrated on PM routines rather than emergency repairs. The approach they have chosen is unique. It's based on a system of maintenance cycles. Here are the basic principles:

1. A machine consists of many wearing parts or components. The time elapsing until a new part breaks down or becomes inefficient is termed its "lifetime." At that time, say the Russians, the part must be replaced.

2. If, from a common starting point, you scale by horizontal parallel lines the lifetime of each part, you will get something like Fig. 2 at right above (assuming a case of a machine with 20 wearing parts).

3. Now you group together all parts with a similar lifetime (encircled groups in Fig. 2). These groups must be chosen with nominal lifetimes so each group is a full multiple of the previous one (beginning with the shortest lifetime as the base). Obviously the lifetimes of some parts in each group would outlast the selected group lifetimes. Aim is to get the smallest number of groups by putting as many parts in each group as possible. Here the result is four groups at 2-, 4-, 8-, and 16-thousand machine operating hours.

4. Next, you bar-chart the number of parts needing replacement at the different operating intervals as shown in Fig. 3 above. It shows that at every 2000-hr. interval the four parts in group I must be replaced. At every 4000-hr. interval the six parts in group II must be replaced; group III (7 parts) every 8000 hours; and group IV (3 parts) every 16,000 hours.

5. This replacement schedule creates maintenance jobs of various types and sizes. To these the Russians give arbitrary code names as follows:

- Inspection (I). Inspection of small elements that can be easily dismantled. Check of wear on certain parts. Inspection of functional quality of machine.
- Check (C). Replacement of worn parts with short lifetime. Cleaning of lubrication tubing or of cooling pipelines. Leveling of machine, adjustment of ways. Cleaning motors. Painting. Functional check.
- Repair (R). Same as "check" plus dismantling half the machine. Repair or replacement of larger parts. Alignment of up to 75% of axes of machine motion.
- General overhaul (G). Complete dismantling. Repair or replacement of larger parts. Adjustment of all axes of machine motion.

Under this scheme of nomenclature the maintenance jobs in Fig. 3 at 2000, 6000, 10,000, and 14,000 hours would be called inspections. Those at 4000 and 12,000 hours would be called checks, and those at 8000 and 16,000 hours would be called a repair and a general overhaul, respectively. When planning for any of these operations, the engineers actually weigh the size of the job quite carefully.

Maintenance cycle—The period of time between general overhauls is called a maintenance cycle. Under two-shift-per-day operation the Russians have experienced the following ranges of maintenance cycles:

- Heavy fabrication—3 to 8 years.
- Auto and truck industry—4½ to 6 years.
- Machine-tool industry—4 to 12 years.

From this kind of research the Russians have developed maintenance cycles for all types of machine tools. Here are a few cycles from a list of 30 types, as well as the shorter intervals between inspections:

Type of Machine Tool	Inspection Intervals (Hours)	Maintenance Cycles (Hours)
Round-material cutting machine, one-spindle automatic lathe, or multi-spindle automatic lathe	800	22,000
Horizontal borer	1600	36,000
Vertical grinder	800	25,000
Tool grinder	400	32,- to 56,000
Planer	1800	36,000
Shaper	1600	24,000
Milling machine	1000 to 1200	32,- to 36,000
Lathe	1000 to 1200	24,- to 28,000
Circular saw	600	25,000
Gear cutter	800 to 1200	24,- to 30,000

Fig. 3 How "Ivan" Builds Maintenance Cycle Structure

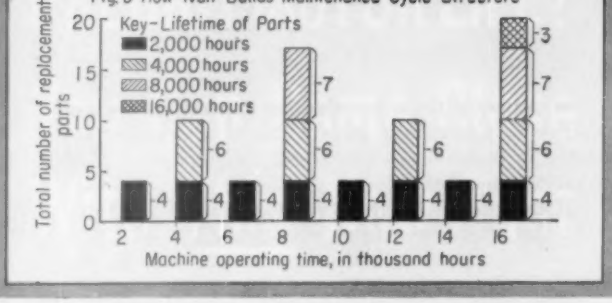


Fig. 4 Work-Hours Per Unit Degree of Complexity

Kind of Operation	Symbol	Hours Per Unit Degree of Complexity		
		Hand craft	Machine craft	Total man-hours
Inspection	I	0.5 to 1.0	0.25	0.75 to 1.25
Current check	C	4 to 7	2 to 4	6 to 11
Repair	R	12 to 20	10 to 12	22 to 32
General overhaul	G	20 to 36	16 to 24	36 to 60

Cycle structures—Take Fig. 3 again (it's for same machine as Fig. 2). Different sizes and characteristics of equipment bring about different maintenance cycle structures. The structure in Fig. 3 is G (new)-I-C-I-R-I-C-I-G. The number of replacement parts installed at 8000 hours, for example, is 17. That big a job is called a "Repair" (R). There are also structures typical of various industries. Russian researcher A. S. Pronikow found that the following industry structures prevail (for simplicity of comprehension, the inspection operation (I) which belongs between every operation is omitted):

- Heavy fabrication, G (new)-C-R-C-G.
- Auto industry, G (new)-C-C-R-C-C-R-C-C-G.
- Machine tool, G (new)-C-C-C-R-C-C-C-R-C-C-C-G.
- Handling equipment makers, G (new)-C-C-C-R-C-C-C-G.

Considerable research is going on continually to find the most effective and economical maintenance-cycle structure. Once a structure has been developed it is mandatory for the entire industry. Any structure, however, is subject to improvement.

How well is this scientific approach working? I don't know. It remains to be proved that the Russian plants are better or more efficiently and economically maintained than, say, American ones. For me, the way the Communists manage their maintenance once more reveals their political and economic philosophies. This cycle approach all looks very nice, well planned. People impressed by it will tend to forget that maintenance should also be economical. Cycle replacement can be costly. The Russians seem to overlook the fact that lifetimes of identical machine parts can vary greatly. Imagine how you would resolve the groups in Fig. 2 if you knew the maximum lifetime of each part could be as much as 20 times the value of the shortest sample. This fact poses no problem for the Communist. If the ministry decides the lifetime of a part is 800 hours, it must be replaced then—even if it could last 2500 hours.

WORKLOAD MEASUREMENT

There has not been any scientific approach to the maintenance problem in the free world comparable to the way the Communists are doing it.

The knowledge of the maintenance cycle structure clearly paces the amount of maintenance work required. In planning time and money to be spent on maintenance, the Communists have classified every kind of equipment by a measure they call "degree of complexity."

Degree of complexity—One unit of the degree of complexity represents 60 work-hours required for general overhaul. For example, a machine having a degree of complexity of 10 will require 600 work-hours.

Apparently every known type of machine tool has been classified by its degree of complexity. A simple example, that of an automatic lathe, will illustrate:

Maximum radius of work piece (millimeters)	Degree of Complexity
up to 10 mm.	4 to 10
" " 50	7 to 16
" " 500	12 to 22

The table for ordinary bed lathes is more complicated, but still easy to interpret. It first classifies the machine by its maximum distance between centers, and then by maximum radius of the workpiece.

The ranges in degree of complexity take care of different types of lathes. Tables for other machines are similarly constructed. Degree of complexity for boring machines runs this way: horizontal bore, 14 to 30; jig bore, 10 to 15; and radial bore, 5 to 12.

These few examples show the extent of Russian appraisal of machine-tool equipment by this method. So far I have seen no data on other types of plant equipment, nor do I know if or how these techniques are applied to process industries.

Specific application—Russian researchers have realized there is some correlation between the work-hours for a general overhaul (G) and those for the other three major types of maintenance operations (I, C, and R). Thus the degree of complexity not only defines the work-hour requirements of a general overhaul (G), but also to some extent of the other jobs (I, C, and G). The tabulation in Fig. 4 shows the range of these work-hours, broken down into hand-craft and machine-craft requirements. Hand-craft represents a skilled maintenance worker who works with hand tools. Machine-craft represents a machine-tool operator. For example: A machine tool with a degree of complexity of 10 will need, for a "check," 40 to 70 hand-craft working hours and 20 to 40 machine-tool operator hours.

The wide hourly ranges for all four kinds of operations show me that the degree of complexity is not a very exact measure for figuring maintenance needs. But you will note the maximum hours for general overhaul agree with those in the earlier definition of one unit of complexity. The advantage of these figures probably is that

a Communist planner is able to roughly plot manpower needed for each job.

The Russians have even found some relation between the degree of complexity and the time needed for cleaning and lubrication. Also, by use of both the maintenance cycle structure (which shows how often to maintain) and the degree of complexity (which shows how much maintenance each operation needs), they can derive a reasonable machine maintenance cost budget.

Manpower planning—Degree of complexity is also being used in manpower planning. The Russians have derived a guide to show the optimum number of maintenance workers to be allowed to work simultaneously in overhauling one machine:

Degree of Complexity of Machine	Optimum Number of Simultaneous Workers
1 to 2	1.4
3 to 4	2.0
7 to 9	3.2
10 to 12	3.7
17 to 20	4.7
29 to 30	5.9

Machine downtime needed for maintenance operations also can be calculated from a guide based on degree of complexity. It gives downtime for the mechanical and electrical parts of a machine, as follows:

Type of Maintenance Operation	Hours Downtime per Degree of Complexity	
	Mechanical	Electrical
Inspection (I)	0.4	0.2
Current Check (C)	6	3
Repair (R)	12	6
General Overhaul (G)	24	12

For example, if a machine of 10 degrees of complexity requires a check of mechanical parts, it will take 60 hours. A separate check (not simultaneous) of electrical parts would take 30 hours.

ARE THEORIES APPLIED?

I'm convinced there is a wide gap between theory and practice in Communist areas. This is a situation not limited to maintenance engineering, and rather typical of the Communists.

All the people I have contacted have stressed the point that these procedures are standard in all Communist-bloc countries. Differences in execution are due more to differences in individual managements than to any other reason. The practices I have described were developed in Russia in the early "Thirties." Scientific application, however, did not start until after World War II.

Although this Russian maintenance system could be operated efficiently, I believe Russian plants are falling short of these standards. (Such was the case of the American plants I toured—many did not come up to the standards published in your magazine.) The Russian tank plant in which I worked was completely run down, as was everything in Russia at that time. Things may have improved since. But I doubt they have reached our standards for the following reasons. Russians and Asians by character do not feel bothered by disorderly living or working conditions. They do not take care of things just because they like to. Lack of competition frees them of the desire to produce as efficiently as possible. So it is doubtful that proper plant maintenance is considered as important as we feel it is. Since all business is government-owned, nobody feels impelled to keep the equipment in top condition. Communists definitely have not succeeded in creating a feeling of pride of ownership in the economy. Finally, Communists don't see the need for practice to equal theory. Their approach to almost everything shows a lack of application of thoughts to facts. The ability to implement, by the way, is probably the most valuable quality of American industry. Many European inventions have been put to practical use in the U.S.A. and then brought back to Europe.

WHO'S AHEAD — EAST OR WEST?

Grothus sums up the contest this way: U.S. plants, on the average, are much better maintained than their Red counterparts. Because of the gap between theory and practice, a trait that may endure indefinitely, I don't think the Reds will ever overtake the U.S.

They have an advantage in being able to evaluate the experience of all industry and to enforce standardization. But this is more than offset by the advantages inherent in free enterprise.

I have little information on the age or condition of Russian plant equipment. I doubt they will ever publish data proving their plants are old-fashioned. But I suspect they are. Internal competition doesn't force the Communists to adopt up-to-date processes. Until recently, the only way they could obtain increases in output was by recruiting idle work forces. These reserves are now being fully utilized.

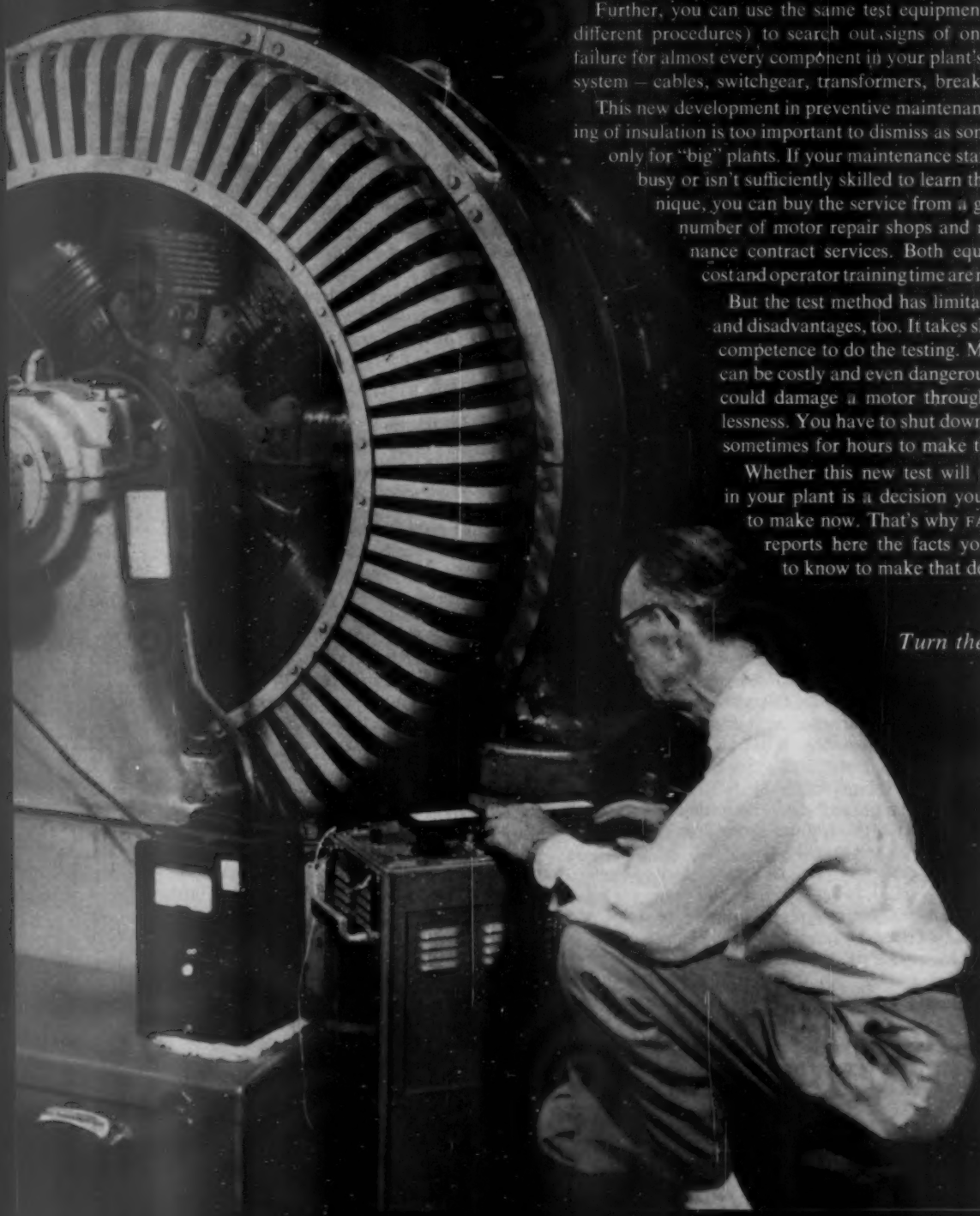
The 21st Communist Party Congress, held last year, ordered investments of 1940 to 1970 billions of rubles for the first seven-year plan. It emphasized that this huge amount, equal to all industrial investments since the Communist revolution, will not only produce new manufacturing capacity but also replace inefficient plant equipment.

Of course, miracles can happen. Russian engineers are being better educated—and in greater numbers. I was surprised at how advanced they are in maintenance know-how. Each year thousands of maintenance engineers from all Communist countries meet and pool their experience.

To assure industrial supremacy, the Western world must continually evaluate the work being done by Communist maintenance managers and apply those evaluations with more success in its own plants.

PREDICT MOTOR LIFE?

You Can Come Close With This New Test



HOW MUCH would it be worth to you to know at all times the amount of life left in every important motor in your plant? $500? $2500? The day you can do just that may be nearer than you think. Actually no one can yet accurately predict the date that the motor on your main compressor will fail — there are still too many unknown or uncontrollable factors. But new test equipment and procedures can come close by:

- Ending unexpected motor failures.
- Avoiding unnecessary or premature motor overhauls.
- Making possible safe scheduling of overhaul, months ahead — at the time when it will cause least confusion.

Further, you can use the same test equipment (with different procedures) to search out signs of oncoming failure for almost every component in your plant's power system — cables, switchgear, transformers, breakers.

This new development in preventive maintenance testing of insulation is too important to dismiss as something only for "big" plants. If your maintenance staff is too busy or isn't sufficiently skilled to learn the technique, you can buy the service from a growing number of motor repair shops and maintenance contract services. Both equipment cost and operator training time are modest.

But the test method has limitations — and disadvantages, too. It takes skill and competence to do the testing. Mistakes can be costly and even dangerous. You could damage a motor through carelessness. You have to shut down drives sometimes for hours to make the test.

Whether this new test will pay off in your plant is a decision you ought to make now. That's why FACTORY reports here the facts you need to know to make that decision.

Turn the page

The test is made by checking the tiny leakage current (usually in microamperes) when far above-normal voltage is applied between conductors and ground. Variations of the basic test are known under different names—voltage absorption, polarization index, *d-c over-potential*, and others. This article will discuss the latter test (call it DCOP for simplicity) because it is used more widely and is easier to perform.

Up to now most motor insulation testing has been done with the familiar 500- or 1000-volt megohmmeter (megger). It's handy, inexpensive, rugged, and quite safe.

The 500- or 1000-volt output from a megohmmeter is sufficient to find major flaws in 220-volt or 440-volt equipment. But it doesn't really stress the insulation the way you need to if you want to predict trouble.

Those plants able to keep ahead of electrical troubles over the years have probably been depending on megohmmeter test records taken at regular intervals (usually annual or semi-annual), and watching for any sign of an accelerating insulation resistance change between tests. But to do a good job of *predicting* failure you need much higher voltages. There's some argument yet over how much, but it does take far more than 1000 volts—even for 220-volt equipment.

If your plant is one that has been ignoring preventive maintenance (PM) insulation testing, now is the time you should take another look—and here's why.

New equipment—During the last few years, about a dozen manufacturers have developed moderately priced, safe, durable DCOP test equipment (a typical 5-kv. unit costs $500 to $750).

Better understanding—Though engineers are still in the dark about some fundamental insulation phenomena, we do have much more data on insulation life expectancy than we did 10 years ago. Many thousands of life tests have been run by users, government labs, and manufacturers, each contributing new facts that help us understand how and why insulation deteriorates.

Backlog of experience—Ten years ago, only the bigger equipment manufacturers, utilities, and a few industrial plants had done any DCOP testing of rotating equipment. Today, the new test method is paying off in hundreds of plants, even those with few motors. Motor repair shops and electrical maintenance organizations have become big users of DCOP testing. And there's plenty of evidence that the number of plants using it will increase considerably. The method hasn't any "legal" status yet as a standard ASA or AIEE test on rotating equipment, but the Navy, after considerable study, recently approved DCOP testing by Navy personnel of both shipboard and shore drives.

HOW ACCURATE ARE DCOP TESTS?

The typical DCOP test gives a series of readings of the current that leaks through the insulation as test voltage is increased. The current-voltage relationship plotted on a curve can tell you three things:

1. Margin of insulation safety remaining in the equipment (by predicting what its breakdown voltage is).
2. Rate at which insulation is approaching the need for cleaning, overhauling, or replacement (by comparing test data with that from previous tests).
3. Cause of the insulation weakness—moisture, conductive dust particles, air pockets, etc. (by careful observation of the rate at which leakage current drops as voltage is raised).

No special competence is needed to provide the first or second reports. With no previous experience the electrician can follow instructions, plot data on graph paper and see if leakage is approaching the danger point. The third report needs an alert test operator who will study a bit to understand what is taking place within the insulation under stress as leakage current changes with time. Example: Liquid dielectrics (like transformer oil) have altogether different current-time characteristics than solids.

There are three other benefits from DCOP testing that come with operator experience and a "history" of tests on equipment over a period of a year or more. First, it will help you schedule periodic PM testing realistically according to the rate of deterioration of machines on an individual basis. Some motors may need checking quarterly—others annually. Second, DCOP testing prior to, during, and after cleaning can help you improve maintenance techniques and cleaning methods. Third, you'll be able to compare insulation deterioration for different types of motors without waiting for failures to occur. You'll be able to run checks on effects of operator carelessness, varying duty cycles, or tough atmospheres.

ARE THERE LIMITATIONS?

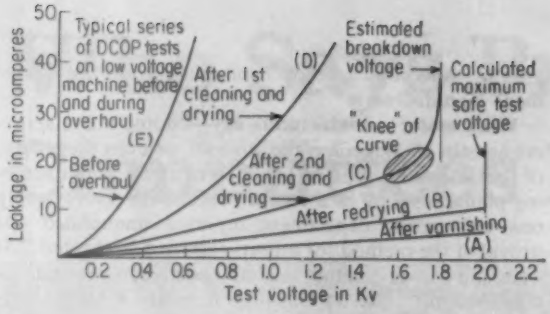
All the above, however, must be considered in the light of what the test *can't* tell you. Experts point out that even the best d-c test probably won't tell you as much about impending motor insulation failure as a careful visual inspection by someone who knows where to look for trouble. In spite of the prophetic twists that some operators have put into their test reports (like "this motor-generator will probably fail about September"), few of the top men are willing to go out on a limb in estimating failure dates, unless both a visual inspection and a complete history of past tests are available.

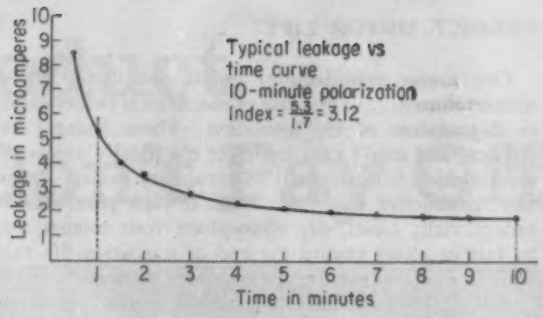
There are some important handicaps to DCOP testing. It doesn't stress various parts of the insulation in the same way they are stressed in normal service or under momentary surge conditions. For this reason a-c over-potential testing remains more accurate in spite of the much greater cost and size of the test equipment. With DCOP testing, you'll still be unprotected against the less common turn-to-turn insulation failures. It cannot find these flaws at all.

Some equipment manufacturers claim that DCOP testing at very high levels does damage insulation. Furthermore, there are records of equipment that broke down at one voltage level without any sign of increasing leakage (a "knee" in the curve) at the previous lower voltage step, thus giving no warning to the operator.

There are many variables not under operator control that can affect test data—humidity, room temperatures, surface dust, winding temperatures, atmospheric conditions following shutdown. Any one of these, unnoticed, can cause misleading conclusions.

Turn to page 70





DCOP TESTING—Here's How It's Done

There is as yet no uniform procedure for DCOP testing of rotating equipment. However, the Navy Bureau of Ships uses a procedure that gives them a "go, no-go" basis for equipment acceptance or rejection. It's a good example of a four-step procedure your plant could follow, so we summarize it here.

1. Clean and disconnect motor—blow off dust and moisture. Record humidity, machine temperature.

2. Determine test voltage points. If insulation is old, peak voltage should be 1.1 (twice the normal operating voltage plus 1000). If it is new, the 1.1 multiplier should be changed to 1.6. Thus a 440-volt-motor calls for a peak test voltage of 2100 volts (rounded off), a 2300-volt-unit—6200 volts. The first test is made at 25% of the peak voltage. The remaining 75% should be divided into about nine convenient steps.

3. Make the first test. Apply 25% of test voltage. Wait for leakage current to reach a steady value. This may take from a few seconds to several minutes, depending on the size of the machine. Record actual values of current and voltage. Four times the initial leakage current approximates the safe maximum leakage.

4. Raise voltage through the remaining test points. Record, plot each after current stabilizes. Good insulation shows almost a straight line plot (Curve A). Old insulation shows increasing current/voltage ratio as test progresses (Curves C, D, E).

WHERE TO DRAW THE LINE

For Navy standards, the decision is simple—critical naval drives must have minimum leakage even if cleaning and drying must be repeated.

The line between safe and unsafe insulation isn't often easy to determine in an industrial plant, especially for non-critical drives. One guide for the decision is the estimated breakdown voltage. You find this by continuing testing beyond the maximum calculated safe leakage.

As soon as the leakage curve begins to move upward (i.e., develops a "knee"), test voltage increments are cut in size. Testing must proceed with care and stop as soon as enough points are taken to extrapolate the curve and estimate the voltage at which it would become vertical. This is the estimated breakdown voltage. If the level is at or beyond the peak test voltage, most experts agree the insulation is safe. If it's below peak, the safety of the insulation is open to question. No one can give you the answer to "how much below maximum is still safe" without considering these factors:

Penalty for failure—The loss of a critical production or auxiliary drive costs more than motors for which substitutes can quickly be made.

Plant motor life expectancy—Some plants can't get the life out of motors that others do. Bad atmospheric contamination, operator carelessness, voltage surges, severe duty cycles, may give one plant far less insulation safety margin than another.

Motor condition—If a motor is old, if the insulation shows signs of degradation, you've got plenty of reasons to start planning an overhaul (or at least a cleaning) of the motor.

What can you do if you're reluctant to overhaul a motor ahead of time? Best thing is to schedule and compare tests every few months. Watch for rising leakage currents. If the knee of the curve continues to shift lower, plan for an early overhaul.

WHAT EXPERIENCE CAN TEACH

Curves A, B, C, D, E, in left-hand chart above, are taken from a series of tests on a low-voltage motor. They show how you can control quality during motor overhaul. If you send motors out for repair, you can make a quick check on quality when they're returned—before putting them back into service.

Any good maintenance electrician will notice, after a few tests, that DCOP testing has a "feel" to it. Insulation that's faulty because of voids causes the meter to react differently than insulation with the same leakage caused by dust.

One of the most useful variations of DCOP testing is determination of an insulation's *polarization index* (PI). (Polarization is the name for molecular changes that affect insulating properties of a dielectric when it is placed in an electric field.) Chart at right shows how leakage current (voltage held constant) drops with time. Normally the PI test is made at the first voltage step of the leakage current test. The 10-minute PI can be calculated by dividing the leakage at 1 minute by that at 10 minutes. If the PI is too low a value, you can expect trouble before the peak test voltage is reached. (Experts are not all agreed on just what the exact value should be.) Some procedures use PI to determine the safe peak test voltage.

One important point: "Cooling off" has to be kept in mind. Any motor winding or cable can be considered as a big condenser—one that can't be discharged quickly. Experience shows how much discharge time is necessary, but experts recommend two to four times as much time for post-test discharging as for the test.

One motor manufacturer points out that 95% of motor failures occur because of mechanical deterioration or degradation of the insulation. These changes are physical and aren't easy to detect electrically unless the deterioration is highlighted by secondary causes—moisture, conductive dust, etc. Thus, if your plant has an exceptionally clean, dry atmosphere your motors may be farther along toward the end of insulation life than your neighbor's, but d-c testing won't show it.

Essentially then, DCOP testing is a new, important tool to help you to put an end to unexpected electrical failures and to plan equipment overhaul on a scheduled basis. It's handy, fast, and because the test results are quantitive and can be recorded, it's more likely to get done—even when the staff is busy—than time-consuming visual PM procedures. But you have to recognize its limitations.

IS DCOP TESTING FOR YOUR PLANT?

All the pioneering work in d-c testing was done by big users of high-voltage equipment like utilities, steel mills, chemical plants, and others who experimented with motor testing, using d-c units originally bought for testing cable. In the last few years this picture has changed, according to test equipment makers. More sales are now to smaller plants and motor repair and service shops who use the equipment to do PM testing on a contract or spot check basis.

One plant engineer tells of his experience with DCOP testing. First time he heard of it was at a recent local SAM meeting. During the next scheduled maintenance shutdown he called in the local service branch of one of the big electrical manufacturers to test his plant's critical motor-generator sets. The test report gave him quite a jolt—insulation had deteriorated a long way without warning. The plant would soon be in trouble unless machine temperatures were watched carefully. Within a year at least one of the machines would have to be rewound. Management now must decide whether to rewind the machines (a $30,000 job) or replace them with rectifiers—but it can make the decision with the facts—and time on its side.

WHAT EQUIPMENT CAN BE TESTED?

Cables—D-C testing of cables is a pretty well standardized procedure—much more so than for rotating equipment. Leading engineering groups have issued specifications which give "go, no-go" criteria for acceptability of cable insulation, both at time of installation and after it has been in service. (For instance, a typical ozone-resistant rubber cable used at 2300 volts should withstand step voltage testing to 39.0 kv. when new, 31.2 kv. when installed, and 23.4 kv. after it has been in service for a while.)

Other equipment—Transformers, switchgear, breakers, pot heads, buswork, contactors, solenoids, heaters, all lend themselves to DCOP testing using appropriate techniques. Generally, utilization equipment protected from surges (by transformers, etc.) calls for lower test voltage than less protected equipment. There's plenty of help available in papers published by AIEE and other groups. And you can expect some help from test equipment manufacturers.

What motor manufacturers say—Motor manufacturers are not all agreed on the wisdom, or even the safety, of DCOP testing. Out of 11 different motor manufacturing plants replying to a recent FACTORY survey, only one engineering department reported unqualified approval of the method for motors (above 5 hp.) rated 220 volts and above. Another recommended it only for ratings over 150 hp. One of the biggest motor makers commented that their motor service organization considered d-c testing a valuable tool, although some of their own product engineering departments were opposed to it. This disagreement over d-c testing of rotating equipment is borne out in dozens of AIEE papers and lively discussions presented in the last few years. The argument shows no signs of abating.

So the manufacturers of the motors in your plant probably won't recommend that you use d-c for PM testing of their motors. Their reluctance may stem more from the customer relations problems involved if a tester makes a mistake than with any conviction that the tests lack merit. More than likely though, their own field service men already use the tests.

WHAT TEST EQUIPMENT DO YOU NEED?

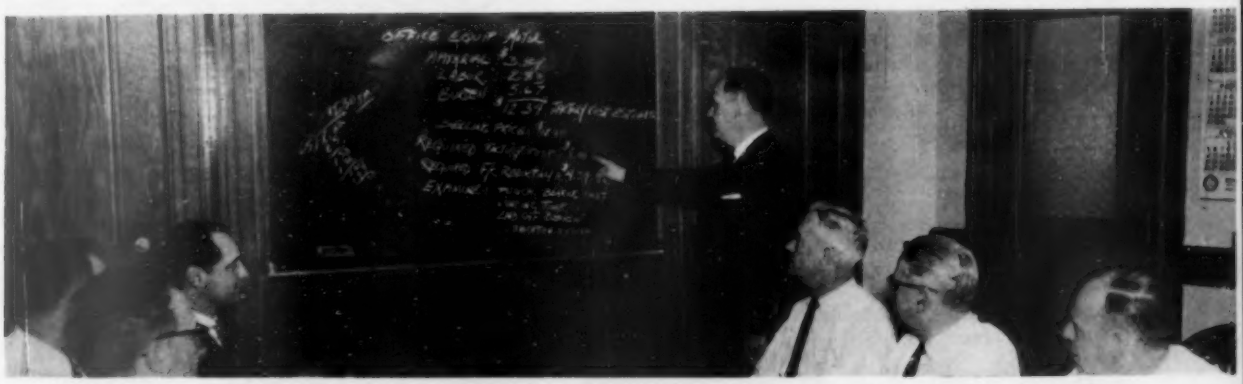
The typical d-c potential test set is compact, lightweight, and portable. Prices start at about $500 for the lowest priced 5-kv. unit (motor and transformer testing only—cable and breakers take at least 10 kv., more likely 40 or 50 kv.). A 40-kv. unit is in the $1500 to $2000 range. Units rated 100 kv. cost $2500 to $3500. Prices vary according to output current ratings and to the number of convenience features available. Most of the equipment available from the dozen or so instrument manufacturers actively in the field is of good quality. It has to be—there's little chance to cut corners on quality without the weaknesses showing up under field test conditions.

About the only auxiliary equipment needed with the test set is a pencil and graph paper. Most of the insulation engineers seem to prefer log paper, claiming it's a more realistic way to illustrate leakage phenomena. One test equipment manufacturer (J. G. Biddle Company, Philadelphia) sells a three-coordinate graph paper (voltage, leakage current, insulation resistance) that "warns" the operator as he plots the curve if insulation resistance is falling.

HOW ABOUT HELP GETTING STARTED?

Test equipment manufacturers furnish fairly complete instructions when the tester is sold. But any maintenance staff should read additional background material. AIEE publications Nos. 51 and 56 are basic references. One of the most complete bibliographies on the subject is included in "Insulation Testing by D-C Methods" (J. G. Biddle Company, $2). Some utilities furnish advisory service for customers getting into the field. They can be a big help along these lines—because power companies have done much of the pioneering in d-c testing on both machines and cable.

Who Says Product Committees Don't Pay Off



Here's one that's credited with gaining $750,000 in new sales, and increasing gross profits as much as 11%—all in one nine-month period. And it could happen to you.

The group of management men in this photo is a product committee at work. Unlike some product committees that look good on paper but show few results, this one works without let-up. Day by day, year in and year out, it rides herd on production methods and materials for National Pneumatic Co., Inc., and Holtzer-Cabot Divisions (Boston), old-line manufacturers of custom-designed fractional and subfractional motors (for instruments and automatic controls), telephone equipment, and door-control systems and other devices for buses and subway, and railway cars.

This committee keeps both eyes wide open all the time—one eye on quality, the other on cost. Why? Because the company sells many of its products on the basis of quality rather than price. And because competitive price pressures, even for premium-quality products, have taken on new urgency in the past few years.

The committee began its work in 1956. Results—new products, redesigned products, new equipment and methods, lower costs—began to come through late in 1957 and in 1958. In one period—the first nine months of 1959—the company measured its achievements this way:

- New sales of $750,000 credited to the committee.
- A 9% rise in gross profits on subfractional motors.
- An 11% rise in gross profits on fractional motors.
- A 35% increase in total sales of motors.
- A 10% increase in sales of telephone equipment. Gross profits maintained in spite of price cuts forced by competition.
- Sales and gross profits maintained at former levels in the transit division, in spite of a shrinking market for this division's products.
- Paybacks on new-equipment investments ranging from a month (in one instance) to a year or less.
- Expectation that the work of the committee in this nine-month period alone will continue to provide $500,000 per year of new business in the years ahead.

Who are the members of the committee? They're a small, tight group, well fitted to the size of the company (500 employees). Though you'll find four sales titles among them, such titles are a happenstance of company nomenclature, for most of these men have moved up through manufacturing, engineering, production control, quality control, design, and the like. Today, in their present positions, they're oriented three ways—to production, to sales, to profits.

These are the men who make up the committee: president, sales vice president, production manager, chief engineer, chief industrial engineer, chief inspector, purchasing agent (essential for make-or-buy decisions), and the sales managers of the company's three divisions—motor, telephone, and transit.

The committee meets once a month for each of the three divisions—three meetings a month. An average meeting lasts about three hours. In the course of one meeting the group will review the profitability of present product lines and the progress of projects now under way. It will also examine proposals for product changes,

new products, capital investments. Here's a nutshell review of what the committee did in one typical meeting:

- Decided to purchase a new coil-winding machine of special design—the only way to continue building a certain motor at a profit.
- Examined the first sample of a new-model motor and instructed engineering and sales to provide further design data that would widen the market for this product.
- Reviewed progress on development of a new servo-motor, found it on schedule.
- Analyzed manufacturing costs of a current development project, then instructed engineering to report on the difference between this cost and the cost of a similar current product.
- Instructed production to set up a schedule for runs on a new motor, samples of which the committee had examined after reviewing costs.
- Revised schedules for several projects—design, engineering, pilot runs, and production.
- Scheduled two projects into the sample and model shop, thus controlling and evening out the flow of work to that shop.

How do projects get started in the product committee? They may originate in the plant, from a customer's need, or in the sales department. Each proposal is described and analyzed on a project-request form. This form calls for the following estimates from departments represented on the committee:

Engineering: material cost, technician hours, engineer hours, model-shop hours, design drafting hours, field trips, and laboratory facilities needed.

Production: Tool engineering hours, methods engineering hours, tooling cost, date of first shipment.

Sales: Yearly volume in units and dollars, monthly unit requirements, desired delivery date, competition's selling price, suggested selling price, and number of samples required.

Controller: Total costs of development and engineering, and estimated factory cost per unit.

Scheduling: Completion of development and sample, completion of production design, completion of tooling, and date of first shipment.

With all this information gathered on a project-proposal form, the proposal goes before the product committee. If the committee approves the proposal, it becomes a project and is assigned a project number. This means that the wheels start turning on development—and that the project becomes one of the matters scheduled for check-up and careful review by the committee at its regular meetings. The committee will shepherd it through to production—and thereafter will call it up for periodic study to see that costs stay in line, that quality holds up, and that the product itself serves customer needs well.

Now, to see some of the results of the product committee's work, look at the photos and captions on these two pages and the next. They show how, if you keep plugging, you can cut costs again and again—and again.

The photos on these two pages show seven changes the product committee designed into just one Holtzer-Cabot servo-motor. The period: May 1958 to June 1959. Purpose: Improve the motor electrically and mechanically, and reduce costs to provide a satisfactory profit margin. Method: Improve step-by-step. Results: Motor as first built sold for $30—at no profit. Same motor today, redesigned and improved with new materials and better manufacturing methods, sells for $22.50—and it pays a satisfactory profit. Total capital investment needed to effect these savings: $21,400. Payback: Less than a year. Present status of project: Continuing. For more methods and materials improvements generated by the Holtzer-Cabot product committee see page 74.

1. Lamination cost cut 58 cents

OLD WAY—Laminations were punched one at a time from strip stock; stacked, counted, assembled by hand.
NEW WAY—A new die punches out eight laminations per stroke, then automatically stacks them for assembly into pole piece.
SAVING—Exactly 58¢ per motor.

2. Stator cost cut $3

OLD WAY—Stator was encapsulated in plastic (l.) to keep chips from sifting onto rotor, becoming embedded.
NEW WAY—Ultrasonic cleaning removes all chips, eliminates need for plastic encapsulation that used to add $3 to unit cost.
SAVING—$3, minus negligible cost of cleaning.

3. Pole-piece cost cut 86%

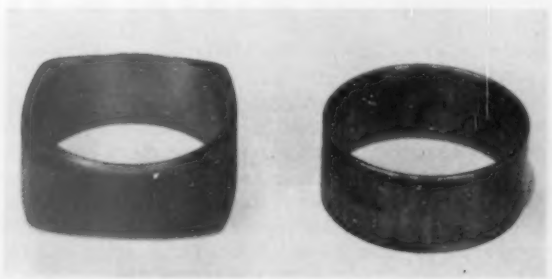
OLD WAY—Seven small pieces of insulation, including two pieces of tape (l.), had to be assembled around the pole piece of the motor. Job was time-consuming. Small pieces made fingerwork awkward, tedious.
NEW WAY—A nylon boot is heated in a hot-water tank, then is shrunk on the pole piece. Job is simple, swift. Fit is tight, sure.
SAVING—Old method cost 43¢ per pole piece. New method costs 6¢. At eight pole pieces per motor, total saving per motor is $2.96.

4. Rotor cost cut 86%

FIRST OLD WAY—Rotor was fabricated from end rings, bars, and laminations (l.). These were assembled, riveted, stacked, skewed, and welded. Cost: 58¢.
SECOND OLD WAY—Change was made from fabrication to die casting. Cost: 60¢ from outside supplier. Why die-cast? Because motors with fabricated rotors showed wide variations in torque value, therefore carried low maximum rating. Die-cast rotors, however, mean no difference, motor to motor, in torque value, therefore carry uniformly high rating.
NEW WAY—Holtzer-Cabot die-casts its own rotors.
SAVING—Die-cast rotor costs 10¢ (not including overhead). That's 50¢ under the supplier's price.

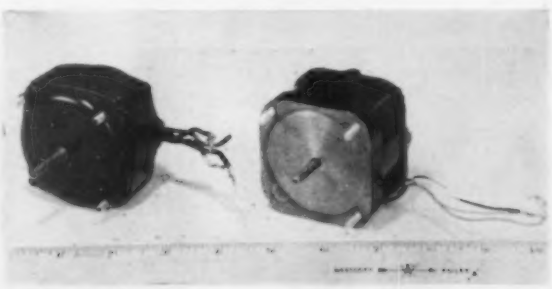
5. Lead wiring improved 100%

OLD WAY—Neoprene-insulated leads (lower left) were thick, which made it difficult to maneuver them through and around the pole pieces in the stator. Heat of the operating motor shortened the life of the lead insulation. It also made its inherently dull color fade to an even duller shade.
NEW WAY—Teflon-insulated leads are slender, easy to hand-weave through the stator. Also Teflon resists motor heat, holds its original bright color throughout the life of the motor.
SAVING—Teflon costs about 11¢ more than neoprene. But assembly labor costs 15¢ less. Bonus value: Customers get a better motor.



6. Frame cost cut 62%

OLD WAY—Motor frame was a purchased casting. Casting had to be bored, drilled, faced by Holtzer-Cabot.
NEW WAY—Motor frame is steel tubing, cut to length by vendor. Holtzer-Cabot just bevels tube edges.
SAVING—Casting cost $1.49. Tubing costs 56¢. Saving is 93¢ per motor.



7. End-cap cost cut 36%

OLD WAY—End-cap design (l.) forbade flush mounting against mounting plate, dissipated heat slowly.
NEW WAY—Flush mounting cuts heat 17 to 18 degrees.
SAVING—Old end cap cost 89¢. New end cap costs 57¢. Improved heat dissipation alone has accounted for a $5000 per year increase in sales of this motor.

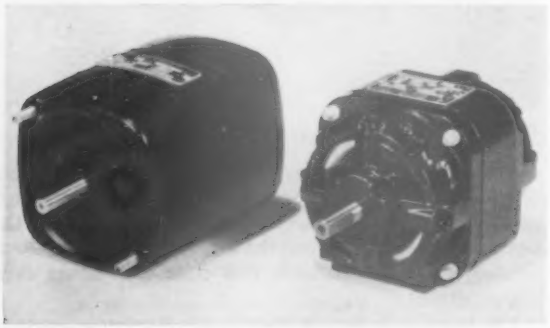
For more Holtzer-Cabot cost-cutters, turn the page

Bracket cost cut 57%

OLD WAY—Bracket for telephone interrupter was a sand casting made of aluminum. Casting had to be cleaned, finished, and drilled. Contact points on spring packs (to be assembled on the bracket) had to be inserted, riveted. Holtzer-Cabot had to cast the brackets in its own plant, and then purchase assembled spring packs from an outside supplier.

NEW WAY—Bracket now is fabricated from plate stock —punched, shaped, and welded in Holtzer-Cabot's plant. Spot-welded, ribbon-type spring-pack contact points are now the only parts purchased. Production of entire assembly is quick and easy.

SAVING—Cast bracket used to cost $7.63. Fabricated bracket costs $1.88. Old spring packs used to cost $9.12 per interrupter. New cost is $5.30. Total saving on telephone interrupter: $9.57. Savings enabled Holtzer-Cabot to cut its price to the customer by 19% without affecting its profit margin. Meanwhile, as a result of the lower price, sales showed a tremendous jump— from 115 units in the whole of 1958 to 1242 units in the first nine months of 1959.

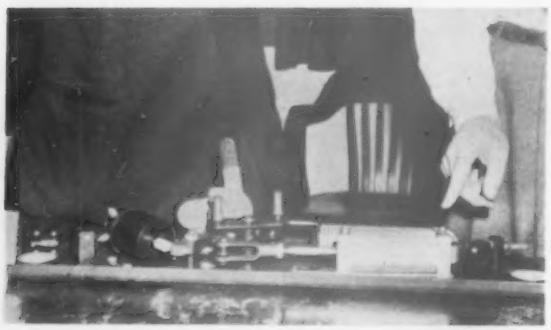


Motor cost cut 39%

OLD WAY—Motor designed in 1955 (l.) went into production in 1957 before the product committee was organized. Cost of the motor (some 50% above original estimate) stuck out like a sore thumb. So this motor became one of the very first targets of the committee. The newly formed committee found the motor designed by an artist—not an engineer. Design was so tight that windings were cramped. Outside surfaces were fine-finished, joints perfectly matched—at high cost. Space was designed for a decal that wouldn't stick. One end of the motor was designed for a hub-cap type emblem that had to be affixed by hand—a tedious and expensive labor step. Besides, some customers complained, the motor didn't even look like a motor.

NEW WAY—In May 1958 the committee authorized a new project—for a replacement motor. Off came the fancy froufrou—decal and emblem. In came space for the windings. Windings were made by machine, no longer by hand. Result: Instead of hand-finished mating edge and a smooth-as-silk enclosure, a simple, rugged motor that looks like a motor.

SAVING—Factory cost of the original motor turned out to be $17.72 (vs. original estimates of $12). In competition it had to sell for $18.90. Factory cost of the motor makes possible a sale price of $17.65. Holtzer-Cabot believes continuing review will squeeze another $2 out of the cost of this motor.



Door-operator cost cut 23%

The new push door operator above is smaller, more compact, less complex than its predecessor. Yet it's more efficient, safer, longer-lived, and costs 23% less.

NEW WAY vs. OLD—The rectangular lever pivoting with stud (extreme right) used to be a casting. Now it's cut from bar stock and the stud is brazed on. The pneumatic cylinder (right front) formerly was made of brass with a cast cap, operated with pressure check only. New model is made of aluminum, with pressure and vacuum checks. The teeter (center) used to be forged. Now it's stamped. The solenoid (left of center) formerly was made in the plant. Now it's purchased (at a saving of $15). There's a nylon bumper for the cylinder piston rod (instead of a hex-head screw) and an extension spring with a sintered metal bushing (instead of a compression spring). Spring used to be enclosed. Now it's open.

SAVING—Factory costs dropped from $62.63 per unit to $48.12. Engineering costs came to $5700, tooling costs to $2900. By mid-November 1958, the company had sold 591 sets (more than enough to recover development costs), compared with only 20 sets in 1957.

A

FACTORY

ENGINEERING AND TECHNOLOGY REPORT

SPOT HEATING

NO. 2

SPOT HEATING
SPOT HEATING
SPOT HEATING

Editorial research directed by Mervin F. Roberts, Associate Editor, FACTORY

The room is warm. But your timekeeper sits at a metal desk that's closed around his feet on three sides. The warm air doesn't circulate beneath the desk. Instead, a cold pocket of air makes his life just one big case of aching feet.

It's snowing and blowing outside. But the plant is comfortable inside. Except at the loading dock. There, snow is sifting in under the rubber gasket of the rolling door, even when it's closed.

Vary these two examples many ways—drafts, blasts of chill air, cold floors, wintry open spaces where jobs have to be done, distant corners in unheated warehouses, damp walls, doors swinging open and shut. Add up the complaints you hear about cold hands, cold feet, cold ears. Count up the number of employees who go home with a bad case of sniffles—who drift away from their workplaces and idle around in warmer areas—whose work records show a lag in productivity in the winter months. Do this, and you begin to see the size and significance of the spot comfort-heating problem in your plant.

The trick is to warm up the cold spots—warm them up without throwing your plant heating system out of balance, without getting buried in complex heat-flow calculations, without making a "Federal case" out of a small, nagging problem.

How do you find the right answer for your particular problem? You can find it by using the guide that follows. It's FACTORY's report on today's problem-solvers for spot comfort heating. It will give you a look at spot comfort heating across the nation. It will help you define your problem, then tell you what the most practical answer is, how this answer works and what it will do for you, what controls and connections you'll need, and what calculations (if any) you'll have to make. These answers, properly executed, will do the following things for you:

- Give temporary spot warmth where permanent space heating would be too expensive.
- Supplement space heating where space heating falls short of comfort levels.
- Reduce employee complaints about cold hands and feet, cold tools, cold workpieces.
- Spare you the cost (and the delays) of sophisticated design and engineering.

SPOT HEATING ACROSS THE NATION

Wyandotte, Mich.—Spot heating applications run across the board at Wyandotte Chemicals Corporation. Some open areas utilize the 55-gal. drum-type coal-fired salamander. But coal-fired units are gradually giving way to portable gas or oil-fired units even at Wyandotte, where coke is a product and coal is readily available.

Wyandotte also uses oil salamanders. These units cost less than $25 and weigh less than 25 pounds. Wyandotte uses them inside as well as outside. Infra-red radiant gas heaters also provide comfort heating, mostly for the paint department.

East Chicago, Ind.—A 40-ft. plate planer with a traveling tool carrier at Graver Tank Division (Union Tank Car) is provided with 40 feet of stove-piped comfort heating for the machine operator. A gas-fired furnace gets added push from a pressure airline directed at the intake. The gas line has a ¼-in. valve. Four ports in the stovepipe can be set to suit the operator.

Pittsburgh, Pa.—The loading platform of the Pittsburgh *Post-Gazette* would be subjected to chilling blasts from the Monongahela River if it weren't equipped with radiant infra-red electric resistance heaters. Arranged in pairs, one is hung over each wooden bench and another is mounted knee-high on the wall under the bench. Each pair of heaters draws slightly less than 3 kilowatts. The area is open only on one side. With a number of relatively small units, rather than one or two of higher wattage, it's easy to put warmth where it's needed and give comfort even at close quarters.

Warren, Ohio.—Worker at coiler end of processing line in the Thomas Strip Mill must stay near the door, despite cold blasts when the door is open in winter. Whenever the door opens in cold weather, a door heater provides a strong downward curtain of warm air, thus tempering the entering cold air. Unit is mounted well away from the opening to clear the fully opened door, is tilted to direct the blast toward doorway. Adjustable vanes at outlet permit control over size and location of the tempering curtain.

Marquette, Mich.—In an unheated steel warehouse of the Lake Shore Steel Division two gas-fired infra-red heaters hang above the shirt-sleeved workmen at a shear. In contrast, just 6 feet away a worker wears gloves, ear-flap hat, and arctic jacket.

Madison, N. J.—An unventilated municipal water-pumping station provides comfort heat for operating personnel with an electric finned-type tube heating unit inside a wall-hung enclosure. There's no maintenance problem, and no venting is required.

Philadelphia, Pa.—Nesbitt, Inc., has an unheated concrete-block shipping warehouse with steel built-up roof. The company provides gas-fired spot comfort over the dispatcher's desk, which is near a door to a loading platform. Three connections are needed—gas, electric, and roof vent. Warm directed air blankets worker uniformly. The unit responds instantly with more heat when the door is opened.

Binghamton, N. Y.—100,000 Btu. per hour from a portable blower unit is just right for one welder in an unheated warehouse at the Stow Company plant.

Turn the page

A BRIEF NOTE ON INFRA-RED

A whole new class of spot comfort-heating devices has come into the marketplace in the last few years. Called "High-Intensity Infra-Red" or "High-Intensity Radiant" they were buffeted about at first by conflicting claims and overselling. But that era is now over. High-intensity infra-red is here to stay. The more you know about it, the better you can take advantage of its properties and avoid its pitfalls.

To begin with, you should remember that heat is transmitted by the three classic mechanisms. They are: conduction (through a solid), convection (by means of a moving gas or liquid), and radiation (rays that pass through air without warming the air). In practice, many heating devices rely on two or even all three of these mechanisms. But, for simplicity, the preponderant mechanism often gives the device its name.

When it comes to radiant heating, a convenient landmark occurs near the point where the human eye first sees a red glow. This red glow varies with people and viewing conditions, but 900 F. is a good round number to think of. This is the region of high-intensity infra-red heating devices. To be most effective, these heat sources should bunch their output in the portion of the spectrum nearest to visible red light. The big difference between this infra-red radiation and steam radiators is that the latter principally generate the "longer" infra-red waves, which are absorbed to a larger extent by the air between the source and what you want to heat. Part of the heat from a steam radiator at about 250 F. heats the air. This warm air, in turn, unless it is blown away, helps warm something else. High-intensity infra-red is generated at much higher temperatures and shorter wave lengths. The air absorbs less of it. Some electrical sources operate as high as 4000 F.

The beauty of high-intensity infra-red is that it is not deflected by air flow. It is especially effective for warming people and their tools in drafty places. It can be focused from a source 20, 30, or even 45 feet away and do a fine job without creating a draft or being affected by a draft.

Granted, prolonged exposure of the eyes to high-intensity radiant heat may cause cataracts. Medical journals have published comments on this hazard. And some industrial doctors, experienced in workmen's compensation, have reported cases of eye damage from long exposure, in some of which the employee's claim was upheld.

But the danger of such eye damage from the typical spot comfort-heating device is negligible. Even so, to avoid any risk, you should set up your heating units so they will not throw focused beams on people who are close by. If you install them in such a way that your people don't look at them directly and constantly (under a workbench or overhead, for example), you'll be perfectly safe. And if you install them in high or distant places, you can focus the beams without jeopardizing your people's health.

How high? How far away? The experts answer only in generalities—so much depends on the shape of the reflector, the available ceiling height, and the warmth required. Best thing for you to do: Talk it over with your heating-unit manufacturer, be sure he's aware of your problem.

If you have a snow problem, remember that radiant energy is converted to heat only when it impinges on an impervious surface. Since snow is not impervious, the use of infra-red on a loading dock will prevent snow accumulation but will not melt much of the snow that has already accumulated.

SPOT HEATING PROBLEMS—AND SOLUTIONS

Getting down to brass tacks, here is a selection of chilblain problems and a simple guide you can use to solve them.

PROBLEM: Work areas under high vented roofs or in the open. No utilities available.

YOUR BEST ANSWERS:

Salamanders—fired with coal, coke or oil.
Portable stack heaters—fired with gas or bottled LPG (liquefied petroleum gas).
Portable infra-red high-intensity heaters—fired with gas or bottled LPG.

CHARACTERISTICS: These units are self-contained and simple. No maintenance needed. They are too big to steal. They vary in output between 100,000 and 500,000 Btu. per hour. They produce both infra-red radiation and convection heating effects. Gas-fired stack heaters with "top hats" for deflecting convection currents out and down are available with one, two, or three stainless steel stacks. LPG-fired infra-red units are equipped with brackets, can be mounted directly onto the LPG bottles.

UTILITIES: None.

CONTROLS: None.

CALCULATIONS: None.

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PROBLEM: Drafty or open areas where people and their tools get cold. Utilities available. For example, open loading docks, large maintenance areas, high-ceiling unobstructed assembly floors.

YOUR BEST ANSWER: High-intensity radiant unit, electrical or gas-fired.

CHARACTERISTICS: Gas-fired high-intensity heaters are often hung from the ceiling. You can hang them with chain and use a coiled length of flexible copper tubing for gas and a few feet of flexible electrical cable at the heater fitting. This way, you can make vertical adjustments of a foot or so and swing the unit as much as 30 degrees to direct the heat where it will do the most good. For maximum efficiency, remember that infra-red can be reflected. Provide polished metal reflectors where you can. Keep them shiny—it will pay off.

UTILITIES: Electricity, or gas, or both. Electrical energy often costs more than gas per Btu. But it requires only one connection to utilities. Some gas units are electrically controlled and piloted. Others with gas pilot flames are available for locations without electric service.

CONTROLS: None required.

CALCULATIONS: Take, for example, an outside loading platform with a canopy and three sides protected from the wind. Dimensions 20x20 feet. Canopy is 13 feet high. Assume the temperature outside will never drop below zero.

If you choose electrical high-intensity infra-red, manufacturers suggest the height of overhead units be a minimum of 12 feet. If they are lower, the unequal distribution of heat between a worker's head and his feet is sometimes uncomfortable.

Manufacturers suggest that at a 12-ft. height you provide 2500 to 3500 watts per 100 square feet of floor surface when there is partial shelter. For every foot over 12 feet above the floor, increase the wattage 10%. For open areas, figure on 4000 to 5000 watts per 100 square feet.

When you work out the problem above, calculation looks like this:

$$\frac{\text{(Area in square feet) (recommended wattage)}}{100{,}000} = \text{kilowatts required}$$

or

$$\frac{(20 \times 20)\,[3000 + (10\% \times 3000)]}{100{,}000} = 13.2 \text{ kw.}$$

Round off 13.2 to 15 kw. Choose 10 units, 1500 watts each. This is a convenient unit size. Elements are available for 120- and 240-volt service. Fewer units at higher wattage could be used if the mounting height were greater than 13 feet.

If you choose gas-fired high-intensity infra-red units, the calculations are different. Don't let the high numbers shock you. Spot comfort heating is not efficient in terms of fuel. When you want to warm just one person in a large unheated space you must compensate for the heat losses into the surrounding unheated areas by at least doubling the amount of energy that would be required for ordinary space heating.

The engineers of one manufacturer of gas-fired units point out that for normal space heating of work areas at zero design temperature, a radiant-heat concentration on the floor of 50 Btu. per hour per square foot is required. In space heating for average construction, you'll get this much heat when you use a burner of 12,000-Btu.-per-hour input for each 100 square feet of floor space. For spot heating, you should double this amount—to 24,000 Btu. For outdoor areas, such as shipping docks, you'll need still greater concentration.

For example take a canopy about 13 feet above the floor. Area is 20x20 feet, has one wall, three sides exposed. The formula:

$$\frac{\text{Area} \times \text{Btu. required}}{\text{100 sq. ft.}} = \text{total Btu. needed.} \quad \text{or} \quad \frac{20 \times 20 \times 24{,}000}{100} = 96{,}000 \text{ Btu.}$$

You'll choose several small units in this instance because the canopy height is rather low. Four 24,000-Btu. units might be appropriate.

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PROBLEM: Open and partly open areas, where construction and maintenance employees work. You want to use equipment that's self contained, portable, rugged.

YOUR BEST ANSWER: Gas- or oil-burning forced-air portable unit.

CHARACTERISTICS: These units vary in output. Smallest is about 100,000 Btu. per hour. Big ones are rated around 1,000,000 Btu. per hour. Some units are said to have almost no carbon monoxide in their products of combustion.

Units are available for burning LPG, kerosene, and No. 1 or No. 2 oil. Some, with integral fuel oil tank, will burn 14 hours without attention. Gas-fired units operate off a tank of LPG and can run as long as there is a gas supply.

UTILITIES: Electricity required for blowers.

CONTROLS: Some units are equipped with thermostats.

CALCULATIONS: For an outside temperature of zero, figure 6000 Btu. per hour to raise 1000 cubic feet of space to 40 F. This is admittedly a rule of thumb, but the applications generally do not lend themselves to heat-loss calculations anyway. Another rule of thumb for protected-area applications: For each desired 20-deg. temperature rise, provide 50,000 Btu. per 1000 square feet of floor area, assuming a ceiling height of 12 feet.

For example, you've got to heat a 20x50-ft. garage with a 12-ft. ceiling so plumbers

SPOT HEATING

SPOT HEATING

can pipe a sump. Outside temperature, zero. Desired inside temperature, 40 F. With the first rule of thumb you can figure this way:

Cube $\times$ Btu. factor = total Btu. or $\frac{20 \times 50 \times 12 \times 6000}{1000} = 72{,}000$ Btu. per hour.

Calculation for the second rule of thumb looks this way:

$$\frac{\text{No. of 20-F. rises} \times 50{,}000 \text{ Btu.} \times \text{sq. ft.}}{1000 \text{ sq. ft.}} = \text{Btu. per hour.}$$

or

$$\frac{\frac{40}{20} \times 50{,}000 \times 1000}{1000} = 100{,}000 \text{ Btu. per hour.}$$

So you will choose one unit rated at 100,000 Btu. per hour.

The two calculations above give answers that differ by 28,000 Btu. per hour. This is not a real problem though, because in this unit class each model ordinarily differs from the next size by about 100,000 Btu.

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PROBLEM: Unheated, unlighted areas where electricity is available, and where speed of setting up and ease of manipulation are paramount. Examples are sumps, under heavy machinery, inside tanks.

YOUR BEST ANSWER: Near-infra-red high-intensity quartz tubular lamp. It gives warmth and light. Light is a trifle pink, but is ample to light a one-man maintenance job.

CHARACTERISTICS: In ⅜-in. diameter, units are available in effective lengths from 5 to 50 inches. Power consumption is 100 watts per lighted inch. Units provide 700 lumens per lighted inch, which is about the output of an ordinary 50-watt incandescent lamp per inch. You can get fixtures for these lamps in various lengths and with one, two, or three lamps per fixture. The electrical power provides directed light and directed infra-red with no warm-up waiting period.

TYPICAL CALCULATION: If the temperature is zero, one man in an isolated area can get necessary light and warmth for himself and his tools with 1500 watts. Units are available in multiples of 500 watts. Three such units, or one 1000-watt unit and one 500-watt unit, would provide ample heat and light for him to do a quick maintenance job.

CONTROLS: None. But, if you like, you can tie the equipment to thermostats, clock relays, or variable auto-transformers for more sophisticated applications. For fast comfort heating, even in areas with combustibles or in unventilated rooms, a man can carry the entire heat and work-light source around in his toolbox.

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PROBLEM: Small spaces that (1) are poorly ventilated, (2) do not have a high heat loss, such as valve and meter pits and guardhouses, and (3) where the heat source must be located close to people without uncomfortable air blasts or intense radiation.

YOUR BEST ANSWER: Electrical low-intensity device giving radiant heat plus convection without forced draft.

CHARACTERISTICS: When you have to meet explosion-proof Underwriters Laboratory and National Electrical Code requirements you must be careful about fittings and details of the installation. You'll get no products of combustion. Relatively low surface temperature. Silent. With appropriate expanded metal covers, this type—usually finned to provide more surface for heat transfer—is often mounted at a height that permits a man to tilt his chair and put his feet right on the unit. Sections are between 3 and 12 feet long and consume from ½ to 2½ kw.

UTILITIES: These units are electrical. They can be installed with interchangeable heating elements. This means that if you find that a unit is too hot or not quite hot enough for the job you have in mind, you can obtain replacements from the manufacturer in other wattages. Swapping the element is a simple matter. Units can be stacked two-high for still greater output. Thermal efficiency at an electrical resistance low-intensity source is excellent. One kilowatt-hour produces approximately 3400 Btu.

CONTROLS: Units can be tied to a thermostat-relay or clock-relay, and output easily controlled.

CALCULATIONS: Take a guardhouse 10x15 by 8 feet high. One 3x7 door, two 4x5 windows. Wood-tar-gravel roof, 12-in. cinderblock walls, 6-in. concrete slab on cinders and earth. Minimum winter temperature, 0 F. Desired heat level, 65 F.

Using factors suggested by handbooks, estimate heat losses through floor, door, walls, windows, roof, and by air change. For this example you'll get total heat loss of about 5500 watts. Call it 6 kw. You can use two 2.4-kw. units, each 12 feet long, and one 6-ft. 1.2-kw. unit.

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PROBLEM: Temper incoming cold winds, especially at doors, loading bays, and freight-car door locations.

YOUR BEST ANSWER: Convection door heater with high-velocity forced draft.

CHARACTERISTICS: Blows large quantities of heated air in controlled pattern. Door heaters are not intended to provide a curtain of warm air that outside air cannot penetrate. They are designed to provide a curtain of air that will mix with the incoming cold air and temper it so the resulting current inside the door is temperate. The door-heating application requires high-discharge velocity to penetrate the incoming blast. Units vary in output velocities starting at 1100 fpm. One manufacturer recommends a discharge velocity of at least 1600 fpm. If there is a negative pressure in the building due to spray booths being exhausted or a large furnace installation, then you might want to correct that situation. If you have less negative pressure, the work load of the door heater will be reduced.

UTILITIES: Steam units prevail, but gas-burning units are available. Fans run off electric motors.

CONTROLS: Door switches alone or in parallel with thermostats are suggested. This way, closing either switch will start the heater. If door switch is used without thermostat, you should provide a manual cutoff for warm weather.

CALCULATIONS: For this application you had better rely on the manufacturer's experience and recommendations. Typical door sizes are listed in the manufacturer's table quoted in part below. Take, for example, a work area near a rolling door that's opened occasionally. Assume inside air at 60 F. as it enters the unit. If the door does not face the prevailing wind you can save some first-cost money with the next smaller size unit. Since these units are often two-speed and thermostatically controlled, a larger unit will adjust itself to the load and not cost much more than a small one to operate.

If steam is available, use it. It's probably cheaper than any fuel you would pipe to the unit. This table (based on 5 pounds of steam) will guide you to the unit you need.

	OUTDOOR TEMPERATURE		
	10 F.	0 F.	—10 F.
Door size (feet)	INSTALLATION NEEDED		
12x22	One unit: 1,200,000 Btu. per hour; 3-hp. fan motor	One unit: 1,300,000 Btu. per hour; 7½-hp. fan motor	Two units: 950,000 Btu. per hour each; 2-hp. fan motors
10x10	One unit: 550,000 Btu. per hour; ¾-hp. fan motor	One unit: 660,000 Btu. per hour; 1-hp. fan motor	Two units: 740,000 Btu. per hour each; 1½-hp. fan motors
6x8	One unit: 320,000 Btu. per hour; ⅓-hp. fan motor	One unit: 380,000 Btu. per hour; ½-hp. fan motor	Two units: 460,000 Btu. per hour each; ¾-hp. fan motors

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PROBLEM: Ventilated rooms and areas that must be kept warm when rest of plant heating system is shut down during off-hours.

YOUR BEST ANSWER: Low-intensity radiant heat plus convection with low-intensity forced draft.

CHARACTERISTICS: Some units are all-electric, consisting of resistance heater and a fan. Surface temperature is about midway between low-intensity finned-type "radiators" and high-intensity infra-red. Gas-burning devices are more economical to operate but usually require venting. Outputs for gas-fired units start as low as 25,000 Btu. per hour.

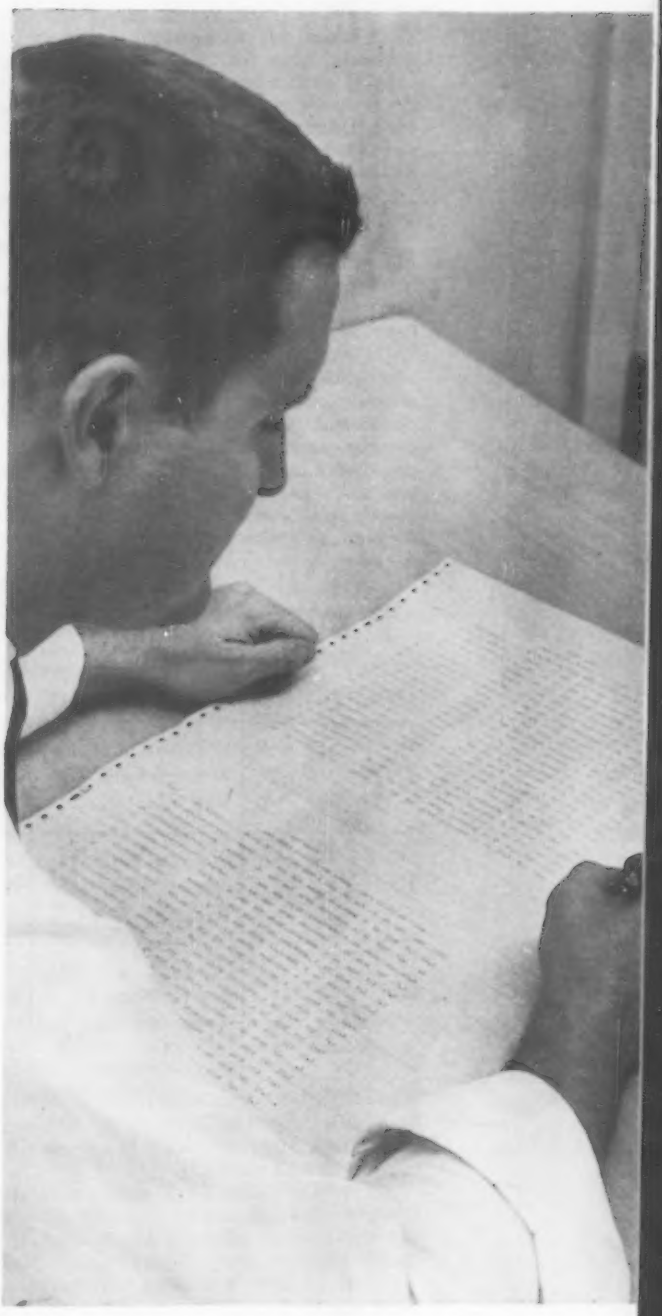
CONTROLS: Two-speed fans and variable inputs coupled with thermostats make units versatile.

CALCULATIONS: For spot heat in unheated areas, multiply the cube of the spot by a factor of 10. The result is the Btu.-per-hour output of the device you need. This is off-the-cuff estimating and is recommended only for spot applications, not for engineered space-heating applications. If the outside temperature is zero, a room in an unheated loft measuring 20x10 by 10 feet high would require 20x10x10x10 = 20,000-Btu.-per-hour output. Choose nothing smaller. Rely on the thermostat to turn it off when the comfortable temperature is reached.

COMING NEXT MONTH:
Engineering and Technology Report No. 3
Warehousing Today—Don't miss this up-to-the-minute account.

SPOT HEATING

Managers at McDonnell Aircraft get fast, detailed production control reports. New system starts with a pink IBM card, culminates a few hours later with a printed status report (right). Pink card (a duplicate is kept in a status file) accompanies material and work order throughout fabrication.



New Card System Speeds Production Control

Skill and time—that's what management needs to keep orders moving through any size job shop. Suppose you had 15,000 parts to schedule daily. You'd welcome a new system that promised to ease this control problem. That's why McDonnell Aircraft Corporation (St. Louis, Mo.) has one of the first installations of a new electronic operation—the "357 Data Collection System" (IBM). First application on special scheduling jobs proved so successful in speeding production time and sharpening efficiency that it is being extended to cover the entire shop. McDonnell's version, with optionals, rents from $68 a month per input station. Without optionals, it's $34.

Order enters an operations center

Control dispatcher reports an order when it comes into his operations center. He punches keys (numbered 1 to 9) of "input station" which codes information about the order related to the operation. He codes the machine group, operation number, quantity of parts received, and order status—that is, whether the order can go into production or must be held up.

Dispatcher codes production control data

Dispatcher drops the pink card into an adjacent card reader immediately after he finishes coding the information on the input station keyboard. Automatically all information on this card, plus operation facts keyed into the input station, travels by cable to the production control center. Dispatcher returns card and work order to its place with the job material.

Control center automatically records dispatcher's message on "current status" cards

"Output card punch" is in the production control center, at the end of the cable from input stations. This output station automatically punches and prints a new card for each report from an operation center. Card has punched holes for machine reading. Current status of the order is also printed on the card. One output station can handle as many as 20 input stations. Operator merely removes cards periodically.

Clerks file current and inactive cards

Clerks file "current-status" cards from originating output punch by part number and work order. At the same time they pull previous card and place it in inactive file. Current status file is used for spot checking of orders and for preparing daily reports. Engineers use printed summaries of inactive cards to study and improve efficiency of order flow through shop.

Machine converts card data into report

Accounting machine converts file of active status cards into a printed report (being read by manager on facing page). Daily report lists orders by production section and order number. Automatically the machine codes orders that have been in a job section beyond schedule time limit. Report preparation is quick, simple, and automatic. Reports can be published as often as needed.

FEATHERBEDDING

a Symptom of MANAGEMENT FAILURE

Today's critical area for plant management: Featherbedding—the work rules issue. The real problem: how to hang onto your management rights, the ones that haven't already been given away.

"Management's Right to Manage" is the title of a penetrating study just released by The Bureau of National Affairs (Washington, D. C.). In it, author George W. Torrence traces the history of management prerogatives over the last 20 years. He describes how management has permitted the erosion of its rights. Points out that some rights have been given away voluntarily, by agreement, while others have been given away knowingly, but under varying degrees of pressure, "ranging from the mild force of argument to the mighty force of a knock-down, drag-out strike."

Some important rights have been given away inadvertently—and unknowingly. Torrence cites the reasons: poor judgment or lack of sufficient foresight in reaching an agreement; poor language; spelling out only part of management rights in the contract; dropping company demands in negotiations; and failure to properly handle cases that go to arbitration.

Then he goes on to explain that many management rights are not lost in negotiation with the union, but by the acts of management in the day-to-day operation of the plant.

Torrence's chilling conclusion, on the basis of the evidence he has gathered, is that "practically all the rights that management has lost in the past 20 years are those that management itself has given away, deliberately or otherwise."

All this has a direct bearing on the featherbedding or work rules issue. Reduced to its simplest terms, the recent issue in steel was a contest between management and the union over power in plant operations. It came down to this: Does management have license to regulate the plant, in all its important aspects? Or must management's objectives be modified by the needs and wishes of employees—represented by their powerful and skillful union stewards and negotiators?

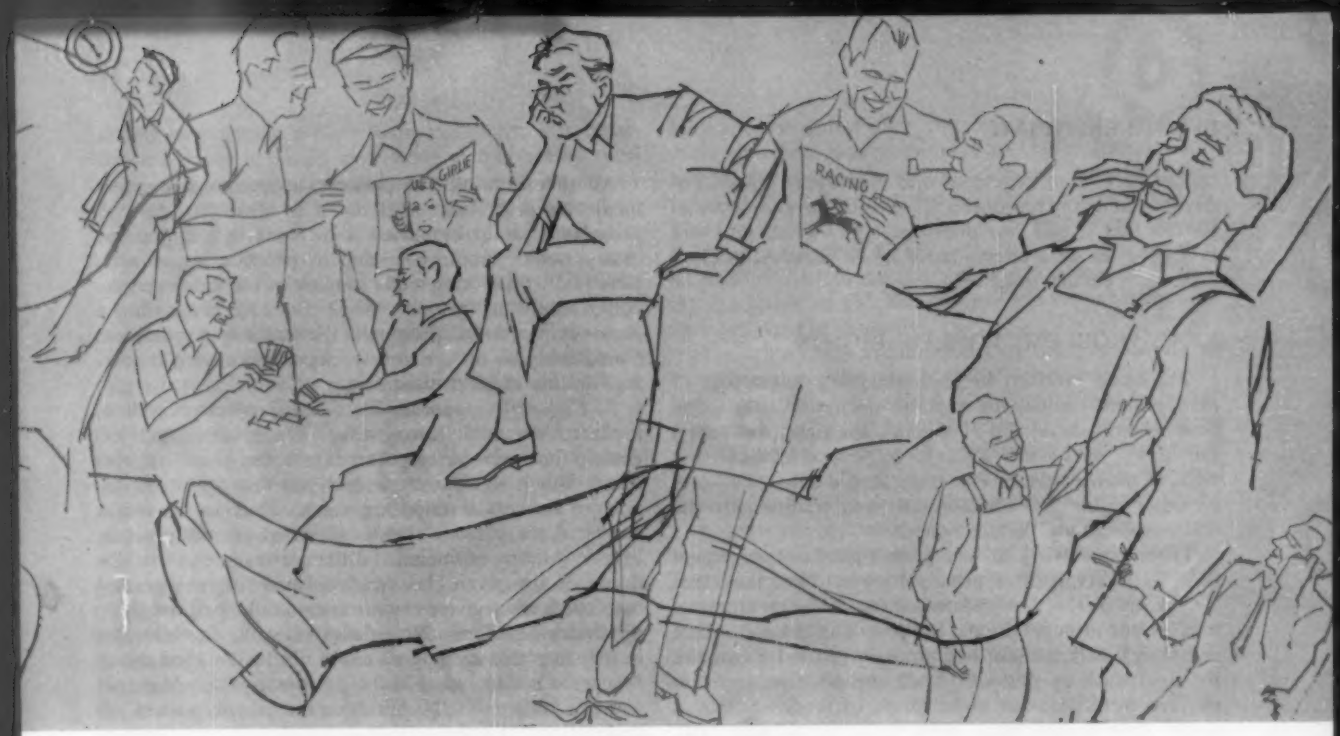
Torrence's book sheds valuable light on the featherbedding issue, because it places the problem in historical perspective. His position on management rights is sound. FACTORY feels it is hard to challenge except on this one basis: The book doesn't penetrate to the basic social changes that underlie the loss of management authority during the last 20 years. And it offers no proposal for a comfortable management-labor peace. It is written to advance the reasons for management-labor warfare, and it outlines strategy for defense.

Within this framework, author Torrence offers useful advice for plant men. He neatly outlines the symptoms of featherbedding (page 86 of this article). He suggests ways that management can hold the line on management rights in the plant (page 87).

Following is a capsule version of Torrence's book, "Management's Right to Manage," with the implications on featherbedding clearly spelled out.—ED.

WHERE FEATHERBEDDING?

When featherbedding is mentioned, most people automatically think of the railroads. If you, too, think of the railroads—if you don't think you have any featherbedding right in your own shop—then you'd better take a closer look. Unless you are a rare exception, it's not a question of whether you have featherbedding—but *to what extent* you have featherbedding.



Here's how featherbedding has hit some plants:

- After installing an automatic conveyor that did the work of one man, an employer found he still couldn't reduce the size of the crew because the reduction would amount to a change in practice.
- An arbitrator ruled that machine operators at one company could not be required to keep a written record of their production. Such a requirement would have eliminated the need for a timekeeper.
- When a foreman tried to step in and help an assembler who was having trouble at his station on the conveyor line, he was not permitted to do so. Instead, the line had to be shut down.
- Plant management concluded, after long study, that quality could be maintained by inspecting every tenth part rather than every third part. High hopes for time savings were dashed when it was found that the inspector still did only a set quota of work.
- A large manufacturer has been unable to institute a major technological improvement because it would eliminate an entire classification of skilled employees.
- A well-known firm is prevented from changing its production standards even though working conditions and production methods have gradually improved.
- An electronics manufacturer is forced to promote marginal employees solely because they have seniority, thus has to pay top rates for second-class performance.
- A firm has tried to subcontract some of its work to achieve better quality and better cost. But it has been forced to bring the work back to its own shop, reinstate laid-off employees, and pay back wages.
- A manufacturer has tried to assign a third machine to an operator who has time to run six machines, but he has been forbidden to do so.

Featherbedding defined—In the strictest sense, featherbedding occurs when there is a rule (either written or unwritten) that requires unneeded workers, or a slowing of the work. For example: A rule may require an employer to staff a production unit with three men, when only two men are actually needed. Another example: A rule may prevent a worker from completing more than a given number of units during any one day.

In a broader sense, featherbedding occurs when circumstances provide a "comfortable situation." For example: A machine operator may outsmart the time-study observer so successfully that the resultant standard permits the operator to waste several hours each day and still turn in a "day's" production.

The annual cost of such featherbedding in the United States has been estimated at $2-billion. But that's for featherbedding in the strictest sense of the word: that is, when there is a definite rule requiring unneeded workers, or a rule requiring a slowing of the work. If the other, more informal types of featherbedding were to be included in the estimate, the annual cost would be far above the $2-billion figure.

Many companies have had to face up to the problem of featherbedding. Here's an actual case. It involves a medium-sized, long-established manufacturer whose name is so familiar you would recognize it instantly. Some years ago this company started to get into trouble. Its major operations were on incentive. But as methods and materials improved it encountered strong resistance from its employees and the union whenever it tried to correct a work standard. As time went on these work standards finally became so loose that employees could get out their daily "quota" of work in little more than a half day.

Meanwhile, the company continued to make a profit. It was in a lucrative business. But the very fact that it *was* in a lucrative business brought the inevitable. Almost overnight, it seemed, more than 50 competitors showed up offering a comparable product at a lower price. The company's sales plummeted, despite belated efforts

on the part of management and employees alike. Today this company has only a fraction of the people on its payroll that it had just one year ago. Whether it will ever get back on a paying basis, or be required to close its doors, remains to be seen.

REAL PROBLEM: LOSS OF RIGHTS

The basic problem in featherbedding is the loss of management rights—the right to decide what is to be done, when, where, and by whom—the right to expect a fair day's work—the right to impose discipline—the right to move, change, eliminate, and create jobs—and all other rights that are normally and traditionally the sole responsibility of managment.

Three good ways to lose your rights—Management loses its rights in three principal ways. Here they are:

1. Loss in practice—Management will sometimes retain a right in negotiations, but lose it in practice. One company's management had strongly resisted a demand for paid wash-up periods. Took the position that employees were paid for eight hours of work—and that meant they should work right up to the whistle. But what was happening? Employees were enjoying a paid wash-up anyway. Supervisors knew about it but turned the other way. Whenever they had tried to enforce the rule against wash-up, there had been trouble.

Another example: In periodic negotiations management had practically shed blood to retain its right to promote a junior employee if he were better qualified than a senior employee. Yet, in practice, supervisors were really promoting senior employees even though they could barely do the job. Why? Because every time a junior employee was promoted, the senior men grumbled. Consciously or unconsciously, supervisors were following the line of least resistance.

2. Failure to communicate—This problem is well illustrated by the following case: Wage scales and job descriptions were incorporated into the plant's agreement. But it was clearly understood that the only purpose of the job descriptions was to describe the major duties of the various classifications as currently established. And by no means did the parties intend that the duties of any given classification were "frozen" or that employees in a given classification could perform only the duties described. Nonetheless, it came to be known in the shop that employees could not be assigned duties that were not included in the job description. Management had failed to tell supervision the true purpose of job descriptions. By the time the situation became known, it was already critical. Management could never recapture fully all that had been lost.

3. Failure to uphold supervision—Again, an example makes the point clear. The contract in one plant pre-

TEN SYMPTOMS OF FEATHERBEDDING

When there is featherbedding, it's usually easy to see—if you really care to look. The truth is, all too few really care to look. It is so much easier to let it be, and act as if it wasn't there. To some, little bits of featherbedding have been the accustomed way of life, and they would consider themselves heels if they tried to interfere—even though the "little bits of featherbedding" may eventually put them out of business.

Here are 10 symptoms of the featherbedding disease to look for in your plant.

1. Controlled Production. When employees turn in the same production, day in and day out, it could mean they have established a "quota" they can easily meet. This practice is far more common than some management men would like to admit.

2. Dissatisfaction-Boredom. When there's featherbedding, employees have a difficult time filling in their day. Usually they get bored and disgruntled. Unless they can find something of interest, they spend a good part of their time grumbling.

3. Gossip-Rumors. In a busy shop there's little time for gossip and rumors. When stories make the rounds, they're almost a sure sign featherbedding is present.

4. Horseplay. In almost any shop there may be one or two characters who are inclined toward horseplay. But if horseplay is common in your plant, look out. Horseplay and busy shops are rarely found together.

5. Poor Performance. The safest people are those who are alert and busy. When the job is just a loaf it becomes dangerous. If there are too many accidents, look for possible featherbedding.

6. Wasting Time. Visiting. Eating on the job. Constant trips back and forth to the drinking fountain and to the washroom. Smoking.

7. Absenteeism. A dull job has little challenge. When the major challenge of a job is to find the means to fritter away time, it becomes distasteful. When an employee is on such a job, the urge is to stay away at the slightest pretext.

8. Gambling. This, too, can be an indicator of featherbedding. When people find their jobs too easy, they look around for other activities to keep their interest up. Gambling and putting pictures on the wall are just two examples of this type of outlet.

9. High Quit Rate. When employees find their jobs too easy, they're likely to be interested in a more demanding situation elsewhere. When an employee quits, he probably won't admit he was bored. But it's worth checking into anyhow.

10. Lack of Pride. Most people are proud of their work and their company. But did you ever notice that when there's a lot of loafing there's little or no pride? If there's lack of pride something is wrong. It could be featherbedding.

served management's right to discipline for just cause. One employee persisted in refusing to follow his supervisor's instructions. Time and again he was told to ready the next part while his machine was in cycle. Instead, he waited through the cycle, then readied the next part after the cycle had been completed. He lost several minutes each time. Finally, the supervisor had taken all he could take of this. He spoke sharply to the employee, and there was a heated exchange of words. The supervisor then sent the employee home with the admonition that when he came in the next day he should be in a more cooperative frame of mind.

Next day there was a grievance. The steward claimed that the supervisor was at fault, that he had been hounding the employee and had insulted him, and that the argument was solely the result of the supervisor's harsh and unreasonable attitude. A work stoppage was threatened. Top management yielded. The employee was given the pay he had lost.

Although the supervisor was not criticized, he was left in a state of bewilderment. The real issue had been overlooked. The only discussion had been about the argument and the words that had been used. Did or did not the supervisor have the right to take action against an employee who had been featherbedding?

Other ways to lose your rights—These three reasons (above) for loss of management rights—and the examples that support them—are the most common. But there are others. Here are a few typical examples:

A crane hooker, whose job was to hook loads onto the crane for movement down the bay, had long periods with nothing to do. His supervisor suggested that he could straighten out some of the bins and clear the area of unwanted material during these slack periods. The crane hooker refused, though there was nothing in the labor agreement that prevented such an additional assignment. The supervisor, by not insisting, endangered a basic management right to assign work.

An automatic screw machine operator was asked by his foreman to take on an additional machine, for which he had adequate time. The operator refused. The foreman just let the matter drop—and then expressed surprise some months later when it was argued that automatic screw machine operators were not required to operate more than a specified number of machines.

On a moving assembly line, the company allowed a 10-minute rest period twice each day for employees to take care of their personal needs. Even so, employees took care of their personal needs at other times, primarily by building a "bank." Then they devoted the rest period to bull sessions. When the company tried to eliminate the rest period on the ground that it wasn't needed, it found it couldn't—at least not without a lot of trouble. By not eliminating it, management gave up its right to expect a full day's work.

An employee loafed on the job. After repeated warnings he was discharged by his foreman. The company's president, sensitive about his reputation in the community, decided that the employee should be given another chance. Result: The employee is still loafing. From the standpoint of the foreman, at least, another right of management is in question.

A millwright, working on a Sunday, ran into a job that was ordinarily done by an electrician. Since it was a simple job, and would have required less than five minutes, the millwright's foreman asked him to do it. Although there was nothing in the labor contract forbidding the millwright to do such work, he nevertheless refused, and demanded that an electrician be called in. The foreman did so, even though he could have insisted that the job be done by the millwright. For that matter, he was entitled to do the simple job himself. In taking the action he did, the foreman placed another management right in jeopardy.

A machine was automatically cycled. According to the instruction sheet, the operator was to burr each part in his free time—while the succeeding part was in the automatic cycle. He didn't choose to do so, preferring to burr the part between cycles. This took additional time. The foreman finally gave up arguing and let the operator have his way. The result: featherbedding.

A conveyor was added to eliminate the time-consuming job of trucking parts from one location to another. But the operators contrived to use the conveyor in such a way that it took more time, rather than less. Supervisors, not wanting to have a showdown, put up with this. They didn't realize they were causing a major break in management's right to manage.

The speed of a conveyor line was increased slightly. The union steward immediately objected. The foreman, after listening to the steward's arguments, agreed to reduce the speed of the line to what it had been before. Without realizing what he had done, he had probably subjected the speed of the line permanently to collective bargaining.

HOW TO HOLD THE LINE

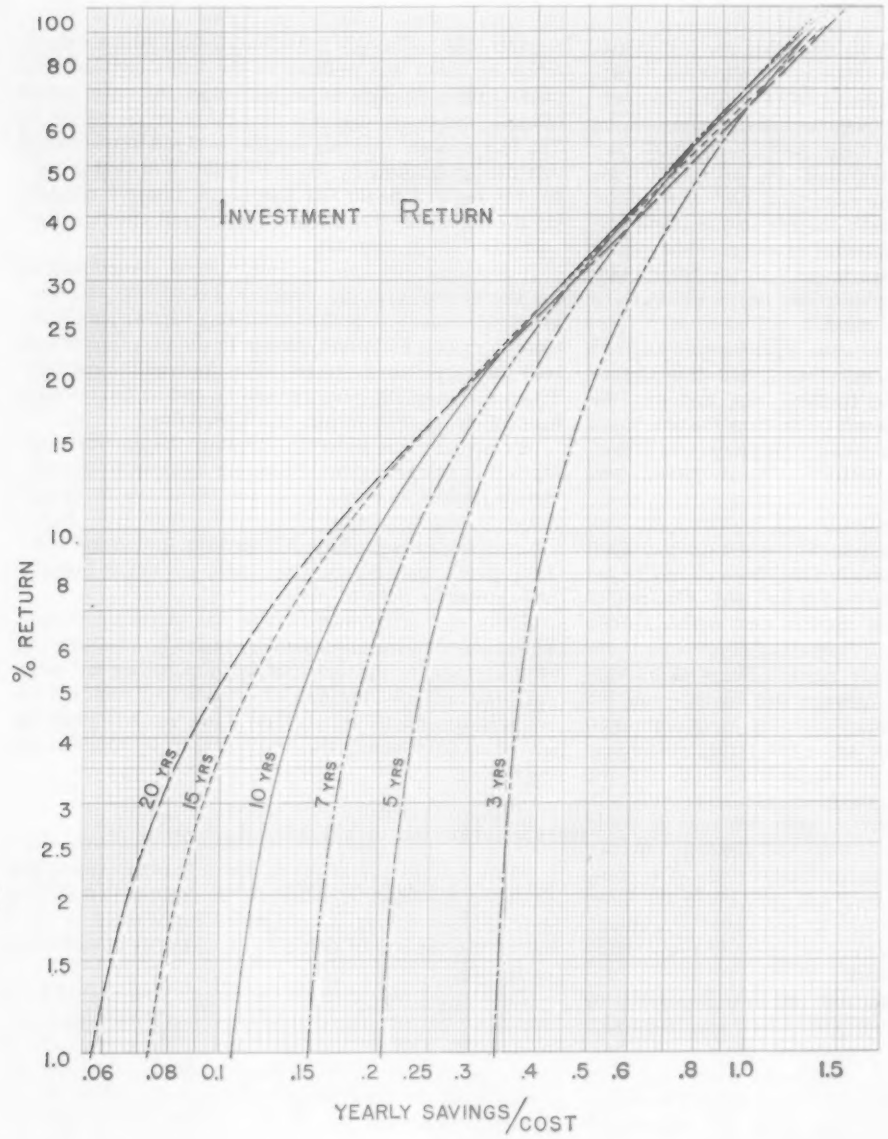
Make no mistake about it. Once featherbedding has gained a foothold, it's difficult to dislodge. And yet, once featherbedding is recognized for what it is—and admitted—the job of doing away with it is already well under way.

First, there should be an inventory. You should find, and list, every practice that has developed over the years to interfere with efficient operations. When you do this you can see the extent of your problem. Perhaps it's minor, and you need concern yourself only with the possibilities for the future. Or perhaps it's severe, and you will be compelled to act as quickly as you can.

If the condition is one that can be corrected without involving the labor agreement, you should still make the correction with caution. All too often a seemingly minor action, if handled improperly, leads to a major controversy or a strong contract demand in the next round of negotiations. Think the problem through. Take it up with others. Don't act until you know precisely what is to be done—and the probable results.

If there's language in the labor contract barring corrective action, be sure that those responsible for negotiating the next agreement are aware of the situation and have the benefit of your judgment. Also, you may be in a position to give the negotiators some valuable information and data that will help them in seeking new language in the contract.

Finally, to hold the line on featherbedding, you must educate others in management so they will be aware of the importance of management rights. They must be in a position to spot problems that involve the exercise of such rights.



Short Cut to Investment Return

Here's a fast, new way for you to estimate investment return. It's used by Cessna Aircraft Company, Wichita, Kan. C. T. Hoard, chief industrial engineer, says the system covers 90% of capital investments.

The method is exact under these four conditions: (1) Cost of investment must all be paid at the same time, i.e., the $1000 paid out for a machine foundation should not be a year in advance of the $10,000 paid out for the machine itself. (2) Year-to-year savings must be constant. (3) Depreciation must be figured by the "sum-of-digits" method. (4) Income tax must be 52%.

To use the chart above:

- Divide yearly savings (S) by cost (C) of investment to get S/C ratio.
- Select the curve on the chart that most nearly matches the useful life and depreciation period of the investment.
- Read off the per cent return on the investment. The answer is directly comparable to a bank interest rate. Says Cessna: "No approximations have been used. Savings are compounded weekly at the annual rate for each year, and then each year is compounded—at the same rate—back to time zero to find the present value."

Hoard reports that the chart also gives an excellent check on longer investment return calculations.

"Are you kidding? I can't fix that,"

said the top electrician (right) when called to fix the giant control mechanism.

His need: more and better MAINTENANCE TRAINING

When the last echoes of the control mechanism's incessant clacking were gone from the plant, panic took hold. The maintenance man who normally handled breakdowns was gone. He was at home with a bad case of 'flu.

In desperation, top electrician Jack Wilson (photo) was called in. His diagnosis was quick and to the point. Said he, "Are you kidding? I can't fix that. I haven't been trained for that kind of work." Jack could be a skilled tradesman in any plant. Even yours. His problem is that the job has changed. He finds himself in a plant full of equipment and processes he doesn't understand. His plant's improved technology has made his skills obsolete.

Jack Wilson is fictional. But his problem isn't. Lack of up-to-date maintenance skills creates a problem in many plants. As one indication of this, maintenance skills training was mentioned as one of their three top problems by 9 out of 18 maintenance managers recently surveyed by FACTORY's Senior Editor Carl G. Wyder.

The pages that follow are at least a partial answer to the myriad of training questions and problems plant men have posed on the subject. They've posed them in interviews, bull sessions, and letters; during plant visits and meetings. The data for the article were gathered by visiting more than two dozen plants, and telephoning or writing many, many more.

Turn the page

By GEORGE A. HOY
Associate Managing Editor, FACTORY

Photos by Leonard Kamsler; taken at Arma Division, American Bosch Arma Corporation, Hempstead, N.Y.

Maintenance training pays off handsomely. But critics find valid fault with training—and trainers.

Plant problems have a way of proving the value of maintenance training. They bring an otherwise abstract subject into a highly practical light. Take Lockheed Aircraft Corporation's Georgia Division (Marietta), for example. Says Supervisor of Instruction George Howard, "Until a couple of years ago, we considered maintenance training a highly informal process. Now, we're getting more and more complex electronically controlled machinery, and we're changing our concept. We have to."

One result of this new outlook: Lockheed put on a 60-hour course on maintenance of a tape-controlled milling machine. As proof of its effectiveness, Howard points out: "The machine is running steadily. And the men who have had our training didn't know anything about it before they took the course. So they must have learned. And we've obviously benefited."

League-leading maintenance trainer Ralph G. Smith of Dow Chemical Company (Midland, Mich.) knows that maintenance training has been solving operating problems for years there. Says he, "Hiring men to do Dow's maintenance work is usually an impossibility. We must train them. We need men who can do all the jobs within a trade. An instrument man, for example, must be able to repair any instrument in the plant." Well-trained Dow maintenance men are able to do just that. Plant supervisors recognize this as a real asset. Says Smith, "They clearly feel that men we train are able to do a better job than men we hire who are presumably already trained."

TRAINING AIDS OPERATIONS

Getting a dollar-and-cents figure to prove the effectiveness of training isn't easy. Many trainers have tried and failed. Plenty have given up. The problem in figuring payoff is that it's hard to prove other things didn't happen during the training period to offset or improve results. But it's hard to completely discount the arguments training men can dig up to support the function. Here are some examples:

Raytheon Company's Industrial Components Division (Boston) called in Dutch training consultants, B. W. Berenschot Company (called RBB for short), to work on quality and downtime. Richard Holl, Raytheon training supervisor who worked with RBB on the job, reports: "After analysis, training was initiated for maintenance men, set-up men, operators, and supervisors. Within three months, we began to see positive results. At the end of the year, our downtime was reduced 40% from its pre-training peak. Quality was improved. Raytheon's cost men figured the return at several times the original investment."

Republic Steel Corporation (Cleveland) cites its workers' ability to spot and repair hydraulic troubles with less shutdown time. They claim fewer breakdowns through better preventive maintenance, and faster diagnosis and repair when breakdowns occur. Improved tonnage and production are also attributed to better training of maintenance personnel.

Dow Chemical Company (Midland, Mich.) doesn't parade statistics on its training effectiveness, but there's a clear implication in Smith's statement: "If we didn't do training, we'd need a lot more men."

Pratt & Whitney Aircraft (Hartford, Conn.) managers have a saying that goes like this: "You pay for training whether you claim it or not. The only question is how efficiently and inexpensively you do the job." This makes a point about training that's often overlooked. The cost of a training staff, classrooms, equipment, supplies, and trainee time are usually charged against a training budget when there's an organized, efficient training program in a plant. But the cost of employee lost time, mistakes, inefficiency, and department disruption is seldom charged to training where there is no formal program. Even if there's a budget for training in the time standards on the job, errors are usually not separately costed as a training expense.

TRAINING HELPS MORALE

When a trainer gets dewy-eyed over his contribution to the worker and his morale, he can rightly expect hard-headed production and maintenance managers to be unimpressed. So trainers have learned to keep quiet about morale. They've concentrated on looking for—and talking about—payoffs in money, quality, and solutions to plant problems. It's almost a rule of the training game never to mention intangible values. But employee morale unquestionably is improved by opportunity. And training provides opportunity for employees.

Says Ralph Sanford, training supervisor at Wolverine Tube Division of Calumet & Hecla, Inc. (Detroit), "Partly, we go in for training as an internal public relations effort. The company benefits by having a long-term employee trade training program. The program supplies the needs of the plant and keeps the men on the job—because they're happier."

TRAINED MEN STAY ON

One proof that training and morale go together is found in the record of losses of craftsmen trained by plants FACTORY visited. All reported the same story: Losses of men trained by the company have been slight.

Dow Chemical Company managers, for example, guess their losses at less than 1%. They attribute this low loss rate to the challenging work the trained man is

able to do, plus his good rate of pay in a skilled job. And men trained by Dow don't have special inducements to stay with the company that aren't enjoyed by all employees.

Pratt & Whitney Aircraft estimates a loss of not more than 2%. In explanation, Technical Training Supervisor Grover Mitchell says this: "Most of the skills we train are best utilized at this company. Few other plants can supply the work variety Pratt & Whitney does."

There's a value for the company in some of its losses, too. While most men who leave Pratt & Whitney give up their field of work entirely (to take over the family farm, for example), the few that remain in the same work often wind up in suppliers' plants, where their skills continue to benefit the engine builder.

BUT TRAINING HAS ITS CRITICS

And much of the criticism is valid enough to serve as a self-examination tool for anyone who is directly or indirectly concerned with training. This includes the plant manager, the maintenance manager, and the production manager—because the fault of poor training often lies outside or above the training department.

B. W. Berenschot Company, Dutch training consultants with U. S. headquarters in White Plains, N. Y., has successfully solved plant training problems for Raytheon Corporation (see facing page), Johns-Manville Products Corporation, and General Electric Company, to name a few.

Johns-Manville's plant industrial engineer and training supervisor, George Van Wyck, reports that the J-M Pipe Division plant at Stockton, Calif., a new facility, was able to reach production quotas in a fraction of the time normally expected—thanks to RBB's accelerated training approach.

Here's what RBB Consultant Jo Benard feels are the five gaping holes in the practice of industrial training in the U. S. today:

1. The wrong kind of trainers—Specialists in training in this country lack plant know-how, according to Jo. Many are educators by training. Workers frighten them. They're not at home in the shop, and they're often not interested in shop subjects.

2. Poor evaluation—A maintenance manager in the shop calls the training department. Says he: "We've got to do something about blueprint reading, my men just can't get them straight." The result of this call, more often than not, is a course in blueprint reading for maintenance men. The trouble with this serene solution to a plant problem is this: there's a good chance the problem won't be solved by better print reading skill. Jo recalls a case in point: The blueprints, on examination, were found to lack standardization in drawing techniques, detail, parts lists and specifications. What was needed was system in the plant engineering department, not a course in blueprint reading.

These first two objections are echoed by some of the best plants FACTORY consulted on maintenance training. Said one manager at a plant with a top training set-up: "Our biggest problem is converting school teachers to training work. They want to administer training. They want to plan a program, get approval, then put it on according to plan. This is wrong. Training may not be called for. And even if it is, the plan could be dead wrong. The training plan may call for 30 hours' instruction. And after 30 hours the men may not know the work. We'd much rather train a good craftsman to be a trainer than train an educator to do training for us."

3. Training is an island—Unless training is coordinated with other plant activities such as quality control, methods, even line operations, it can ruin the newly trained man's attitude. The trained man needs support in tools, organization, and many other functions. For example, take the case of the man who's trained to refine his care and usage of fine instruments. If the plant procedure for keeping his gages in calibration isn't adequate, he'll be better able to sense it with his new training. He'll be motivated to do a better job, and annoyed when he doesn't get the support needed to do it.

4. Gripes don't register. A wealth of valuable information comes from the students in a skills course if the instructor is tuned to it. One maintenance crew is an example. The inefficiency of the three-shift operation was obvious. That's why RBB was called in. The foremen on the job blamed worker skills for the inefficiency. The men blamed the absence of a procedure to coordinate the work of the three shifts. As it turned out, the men were right. Tests proved they had the necessary skills. The problem of efficiency was solved when the shift foremen worked out a system for planning work for all three shifts instead of each for his own shift.

Gripes, if listened to, often put the trainer on the spot. He teaches a man the right way to do a job. The man reports that his boss won't let him do it that way. Now the trainer has a problem. If the worker is right, he must take his part, help him out. Many trainers won't do this. They side with management even if the issue is clearly in the worker's favor. This, according to Jo, is a sure tipoff to the ineffectual trainer. He must do something about operating problems he uncovers, or he's not worth his salt.

5. Lack of top acceptance. Go to a meeting of training directors in the city nearest you. There's a good chance the program will include a talk on "getting top-management support." Why is this a problem? (And it is a problem in many plants.) For three reasons:

First, because the training men don't deserve support. They don't render valuable service. Plenty of plant training departments are staffed with men who failed at other jobs. Many American training departments are shelves where management conveniently squirrels misfits away.

Second, because training is so often part of the personnel department, rather than of the line departments, industrial engineering, maintenance management, or other service departments. RBB feels training should report to industrial engineering rather than to personnel.

Third, because training doesn't implement new ideas. The training staff in too many plants sees its function as one of helping to meet the plant's main problems. They don't assume responsibility for keeping techniques timely, for pushing new methods, for finding solutions to problems before they cause a breakdown in the plant.

Turn the page

Step 1, Prepare the Man

Step 2, Show Him, Tell Him

Step 3, Let Him Try the Job

Step 4, Follow Up . . .

Training principles are simple, solid— and often ignored.

Electrician Bill Endicott looked up from his work as he heard footsteps approaching. It was his boss, Maintenance Chief Paul Sands.

"C'mon," said Sands crisply. "There's a breakdown on the new mill. I'll show you how to fix it."

The two men walked silently toward the center of the plant. The giant mill was quiet, and surrounded by anxious-looking production guys. Endicott had seen the mill often, but didn't know much about it.

As they approached the mill, Sands broke away from Endicott and sought out one of the production men. They talked rapidly for a few minutes. Sands turned back confidently. "It must be a relay," he said. "Follow me."

He led the way to the rear of the machine. He removed a panel facing and opened it. Thirty seconds later a motor started. "We'll need to replace that relay soon," he said. He looked pleased with himself.

Endicott wasn't quite so pleased. The only thing he had learned was how the panel facing was removed. "But," he shrugged, "Sands is the boss. If he doesn't want me to know how to make repairs, that's his business."

This is a classic example of what's called on-the-job training in many plants. Endicott didn't learn because even the simplest rules of training weren't applied. No preparation, no explanation or demonstration, no chance to try, and no follow up. These are the simple JIT (Job Instruction Training) principles illustrated at left.

PREPARING FOR TRAINING

Most skilled workers have a long history of interest in learning new things. Otherwise they wouldn't be skilled. But the skilled man's built-in motivation for learning doesn't excuse you from the preparation phase of skills training.

Plant Engineer Bill Sanders (foreground, bottom photo) recognizes this. He manages plant maintenance at Arma Division of American Bosch Arma Corporation (Long Island, N. Y.). Bill doesn't give a long, complicated talk before he assigns a man to full-time observation of a new installation. But he does chat about it with the man, helps him to see the advantage both he and the company will gain from the new knowledge. It was that way when the giant machine in the photos was installed. It's the largest precision centrifuge in the U. S. And its hydraulic system is critical.

MAKING EXPERIENCE COUNT

The two middle pictures (left) deal with the part of the training job that concerns manager and trainer most. The experience can be frustrating and fruitless (like electrician Endicott's) or highly profitable. For best results, the man must be able to try out his new knowl-

edge as he learns. Says Maintenance Manager Clarence Schatz, Scott Paper Company (Chester, Pa.): "New foremen claim they get 'sick inside' watching men make mistakes. But you have to let men make mistakes—within time and expense limits—if you want good learning."

The best training set-ups FACTORY found included tryout as an integral part of the training design. Pratt & Whitney Aircraft is an example. The company has a large training staff, good classroom facilities. Instructors are required to spend about 25% of their time on the plant floor, making sure the craftsmen-students are applying their new knowledge right. And this is after they have tried out their newly learned skills on mock-ups in the classroom or training shops.

FOLLOWING UP—OFTEN

There's a hard-to-distinguish point in the training sequence where the man has really learned the job. At this point, the trainer's contribution changes. Bill Sanders at Arma keeps his contacts high for the first few weeks after training. Says Bill, "It gives me a lift to see one of the men emerge triumphant after repairing a complicated piece of equipment." That's what has happened in the bottom photo.

Most men who have learned a trade are proud of it. And they're pleased when they can feel they've advanced their knowledge. But this isn't to say that more rewards are pointless. Republic Steel has a regular graduation exercise for the top craftsmen who complete courses. The affair begins with graduation speeches. Then there's a presentation of diplomas. The evening is capped off with refreshments. There's even a printed program, with each graduate's name listed. Proof this is a hit: Attendance is always 100%.

Good training demands good men to train.

Ask plant men what the most important part of any training process is, and most will answer: "getting the right man to train." Said one midwestern training director, "If we get a good group to train, the line is almost always satisfied with the results. If we get a mediocre group, the line foremen can almost be expected to get in some nasty digs about training afterwards."

There are two hurdles in the way of good selection. One is a supply hurdle. The trainer often is stopped dead in his tracks because of its height. A maintenance manager in one southern plant had this to say about selection: "Only a handful of our men, even at the supervisory level, have had any training beyond high school. And many of our men didn't go very far through high school, either. This is no small problem when you're trying to find men to train for a complicated course in electronics or hydraulics."

The second hurdle is high, wide, and intangible. It's the hurdle of knowledge about the ability and potential of employees who haven't been in training before.

Psychological tests are perhaps the best and most controversial known aid to selection. Test users have a hard-to-refute argument on their side. They figure that any shred of information on a man's ability is useful. But the opponents are vigorous and sure of themselves. They claim the tests don't really prove anything, and may mislead you.

THOSE IN FAVOR OF TESTS

At General Mills, Inc., Minneapolis, tests play an important part in licking skills problems. Men must pass a battery of mental fitness tests—mechanical comprehension, mental ability (adaptability test), and arithmetic—before they can even qualify for maintenance work. Steps up the maintenance job scale are made on treads of successfully completed exams. "The procedure is designed to keep misfits out," says Glenn R. Harmon, manager of training.

Dow Chemical Company uses standardized psychological tests, including such favorites as the Wonderlic Personnel Test (to measure basic ability to learn, reason, and solve verbal problems), the Bennett Test of Mechanical Comprehension, the Purdue Industrial Mathematics Test, and the Minnestota Paper Form Board (a test of ability to visualize how parts of an object fit together to form a whole). Dow also uses tests originated in its education department.

Can tests be used in a company with a seniority clause in the union contract? When there's a maintenance opening at Allied Chemical Corporation's Solvay Process Division (Detroit), tests are given first to the highest seniority man who wants the job. If his scores are too low, the tests are given to the next highest seniority man, and so on down the line.

THOSE OPPOSED TO TESTS

Republic Steel Corporation's outside training group, The Human Engineering Institute (Cleveland), emphatically refuses to use tests. The reasons: It feels the men could be embarrassed by the prospect of tests if they've had limited schooling. Many have only an eighth-grade education. Also, it feels the men will suspect it of trying to "get something on them."

There's no word mincing about tests at Pratt & Whitney Aircraft. The company once used tests, but found no correlations that made sense. Test scores didn't aid in predicting who would make the better students. The tests did spot the extreme odd-balls, but the company's interview procedure did this job equally well.

Selection of men for training at Pratt & Whitney is now a line responsibility. Suppose it's for a course in electronics. The electrical foreman and the plant electrical engineer, Bill Morton, pick out men they think can learn the subject. They consider the man's job performance, his enthusiasm and motivation, his willingness to learn. It's all subjective, but at least it's based on a lot of experience with the man in his work environment. Practically every plant FACTORY visited used supervisory judgment in somewhat this way, with or without the added information tests could provide.

Turn the page

Maintenance training begins with careful, questioning study.

Papermill Road winds its sleepy way north out of the tiny town of Newark, Del. About three miles of rolling farmland lie between the Newark traffic light and Du Pont's huge Louviers (rhymes with two gears) building, an isolated working environment for about 2100 engineers (plant, process, construction and service engineering) and supporting personnel. This is the working headquarters of maintenance engineer-consultant George O. Pitts. His specialty: maintenance training.

Not surprisingly, George has resources that would make most maintenance trainers sick with envy. His files are crammed full of carefully developed, illustrated course material on every imaginable subject in the maintenance skills field. The Louviers building boasts a top-notch library.

George and his men make their service available to Du Pont plants exactly as an independent consultant would. The service is a four-point program of (1) determining needs, (2) finding or training a plant trainer, (3) preparing materials, and (4) figuring out the best way to present the materials.

This four-point plan reads like a textbook. It's standard for the training business. But Du Pont's method of determining training needs is a sophisticated brand of the art seldom practiced in industry. It's not unique, but well worth examining in detail.

DETERMINING TRAINING NEEDS

Suppose George Pitts gets a call from a plant. His first visit launches him and the plant into a detailed study of each craftsman's skills.

Pitts interviews foremen and the plant's higher maintenance supervision. He also reviews work orders and observes the job. His aim: to develop a list of work activities for each craft group or group of maintenance men doing similar work. He makes up an analysis work sheet (like the simplified model at right) for each group. The names of the men in the group are entered across the top. The work skills they are supposed to have are listed along the side.

Next, Pitts asks the foremen questions from the work sheet. For example: "You have to make up a high-pressure pipe joint. Would you assign Jones to the job?" If the answer is yes, he then asks: "Is Jones excellent at this work?" In the square opposite high-pressure joints, Jones is graded zero if he couldn't be assigned the work. That means he hasn't the minimum skill required for that operation. If he could be assigned, but isn't regarded as an excellent workman at this task, he gets a check mark. If his foreman says he's excellent, he gets an "X" in the square.

Pitts asks this question about every man on the list. Then he does the same with the next question. Eventually, the entire chart is filled in. Whenever possible, the foreman's opinions are checked by a repeat procedure with another foreman or manager who knows the men. Sometimes a man recently promoted to general foreman will be able to judge the men's abilities. Sometimes a relief foreman will know the men well enough to act as a check on the first foreman's judgment.

Foremen are almost always amazed at the worker skills they have at their command when they see them marked on the finished chart. They haven't been told to think in terms of training during the audit phase of the work. But the training implications of the chart are readily apparent to them after it's completed. Some benefit, Pitts feels, grows directly out of the impact of the audit on the foreman.

ANALYSIS—IT TAKES REASONING

With the chart for each work group completed, Pitts makes up a master chart for the plant. It's a listing of all craftsmen and every skill that's needed. These can be totaled across and down, to determine how many men in the plant are skilled at each kind of work.

If a sizable group of men lack a specific skill, Pitts may recommend course instruction. But not always. If 15 men, for example, are incapable of doing an important basic job such as making high-pressure joints, instruction would almost always be recommended. But suppose it's discovered that six out of ten pipefitters don't know logarithms. This is knowledge that's seldom required. Pitts wouldn't recommend a course in logarithms under these circumstances.

Next step is to get agreement on subjects that require training. With the proper approvals, Pitts and his staff put together training units from their files, develop new material, or suggest use of outside training facilities such as the correspondence schools. If the training is to be done by Du Pont, Pitts and his crew either train the plant men who will do the training, or do the training job themselves.

SURVEY OF TRAINING NEEDS

Work Chart

WORK	Jones	Smith	Brown	Black
Making up high-pressure joints	✓	0	0	0
Installing flanged joints	X	✓	✓	✓
Installing and servicing valves	✓	✓	0	✓
Working with pipe hangers	✓	✓	X	✓
Working with orifice flanges	X	0	0	X
Installing steam traps	X	X	✓	✓
Pouring lead joints	✓	✓	0	X
Installing lavoratories and water cl.	X	✓	✓	✓
Hydrostatic testing	✓	0	0	✓

0 Can't do

✓ Adequate skill

X Excellent skill

NEEDED: FREQUENT CHECKBACKS

Du Pont's system for pinning down training needs is thorough, scientific, and good. If there's a flaw anywhere in the system, it's the same flaw that's to be found in the work of any consultant organization—there's no built-in way to keep abreast of changes in the plant situation. And most plants FACTORY editors visit are like a kaleidoscope in the hands of an active youngster.

The way plants change, an audit done this year could easily be completely out of date next year. A few years ago, electronics was a skill seldom needed in plant operations. Not so today.

FIRST, A PLANT PROBLEM

We can assume there's a plant problem behind every request, says George Pitts. In that respect, at least, there's little difference between giant Du Pont and other plants visited in the course of this study.

The problem needn't be a crisis. It could be as pleasant-sounding an event as the placement of an order for a new machine. The maintenance manager is delighted, of course. But he knows the new equipment will tax his men's skills. And he knows that complex skills aren't learned overnight. So he yells "wolf" when the order goes out, rather than wait until the new equipment is growling through the plant doors.

LINE REQUESTS CAN BE WRONG

Let's face it—it's human nature to pin the blame on somebody else when a problem comes up. In the plant this often means, for example, that the maintenance supervisor who does a poor job of helping his men plan their work blames his crew's inefficiency on "those lunkheads." "They don't know what they're doing," he says. "Let's get them some training so I can get some work done." Training may be needed, all right. In this case the supervisor needs training on planning.

Top trainers FACTORY interviewed commonly cited examples of problems they were called in on that turned out to be physical rather than educational. At Pratt & Whitney, the analysis phase is one part of the training cycle where trainees sometimes act more like engineering consultants than like educators. In such cases, they often return the verdict: Skills not guilty.

Suppose a new piece of equipment has been installed, and there's trouble. One possible reason is lack of skill on the part of the operator or maintenance craftsmen. But it's also possible the trouble is in the equipment itself—not in the operators or maintenance men.

The analyst's job is to decide the real reason for the problem. He can't get a good answer by questioning the supervisors on the job. That's the common approach, but there's a giant hole in the reasoning behind this practice. The supervisors are the men who call the trainers on the job in the first place. They have already decided that the problem lies in skills, and should be handled by skills training.

A Pratt & Whitney investigator is expected to do a research job. He may go to the equipment manufacturer. He may work at the machine himself. He calls on his knowledge and background, plus the resources of the training department, to find the real cause of the trouble. His recommendation may not be for training, but for different equipment, personnel changes, equipment modification, or even product changes.

In one case, a training man was called in to survey training needs because of a problem on a large grinder: Too little production was creating a bottleneck. The factory manager and the trainer cooked up a way to reengineer the machine controls to gain speed. Result: Less wasted time, problem solved, no training needed.

Not every analysis turns up a technical or managerial culprit responsible for plant problems. Skills often *are* the trouble. If so, this time-tested procedure is initiated in most of the plants FACTORY queried:

The trainer must decide the best way to build new skills in the workers who need them. He considers the subject matter, abilities of the man to be trained, facilities (classrooms, reference material, and trainers), amount of time he has in which to train the men, and the plant's past practices (a sudden change might upset everyone and interfere with job completion). It's no simple matter, and there's no set formula for weighing all the variables and finding the best solution.

ARE CLASSROOMS ALWAYS NEEDED?

Some plants have never done classroom training of craftsmen. Take Scott Paper Company, for example. Maintenance trainer there is Clarence Schatz. He's maintenance manager. His department totals 212 men. Clarence makes decisions on training within the framework of his own firm convictions and established plant practice. Says he, "We're not forced into big training problems. We're training all the time." (FACTORY finds that plenty of plants say this, but the claim doesn't always hold up. It does hold up at Scott.)

"We hire men who have good grounding in their craft, plus a hobby interest (also in their craft) that keeps them abreast of developments in the field.

"Then we show our confidence in them by assigning jobs in terms of objectives rather than elements. For example: We'd never give this kind of job assignment: 'Joe, go fix a leak in the heater. Bill and John, you go along and help.' Rather, we'd assign the work to all three men this way: 'We're getting hard water back in the hot well. Will you take care of it?'

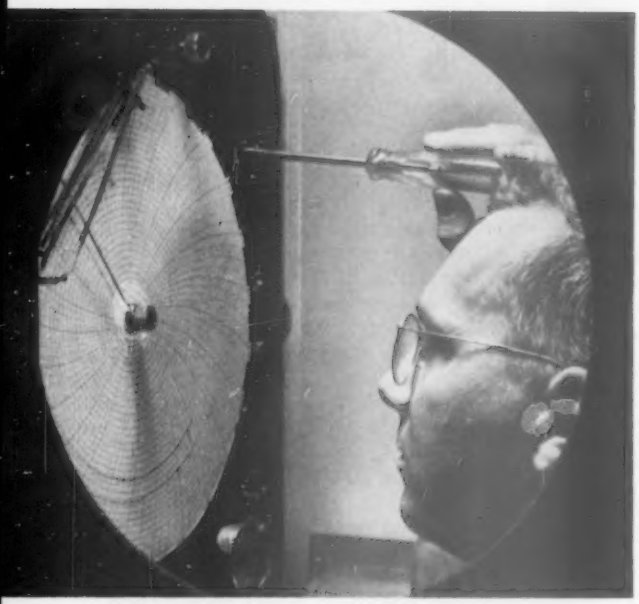
"We also stimulate our men by giving them a great deal of influence in equipment selection and design. Salesmen are encouraged to go out on the floor and contact the craftsman who knows most about the field. We encourage our men to grow with their interests this way. And our biggest problem is to keep up with them."

One problem in this kind of informal approach, of course, is to get foremen to follow the system. It's human nature to want to act important and give detailed directions in job assignments. And it's human nature to get impatient when a worker doesn't do a job as quickly or as well as you would. "Our new foremen," says Clarence, "get excited when a job is done inefficiently. I tell them to imagine the craftsman is his brother. And I keep the pressure off the foreman as much as possible. Otherwise, it's hard to get the foreman to assign a job to a man who hasn't done it before. That may be efficient in the short run, but not in the long run."

Turn the page

Training programs—in large plants and small—are updating craftsmen in new, complex skills like those below.

Special Plant Equipment



Instruments and Controls

Electronics

Like a scientist taking the last cautious step in a long experiment, American Bosch Arma employee Mel Goodhue (top photo) coddles a complex testing apparatus called a Wenner bridge. His face is reflected in its glass-clear oil as he works to maintain its accuracy.

Mel's bridge is one example of many technical marvels that require maintenance at Arma. Another is the plant's superclean room. The specialist in the second photo is regulating its temperature-humidity controls. A third technical marvel with maintenance implications is the sidereal unit, a piece of equipment that tests gyroscopes by holding its aim on the star Polaris, continuously compensating for the earth's spin and orbit. The electronics man in the lower photo is adjusting the unit that records the gyroscope's test performance.

SPECIAL EQUIPMENT—SPECIAL PROBLEMS

America's technology has a way of humbling even the best of maintenance forces. Lockheed Aircraft's (Marietta, Ga.) capable maintenance department met its match when the plant acquired ultrasonic gages. General knowledge just didn't bridge the gap between what the men had worked with in the past and this new equipment. So the company developed and conducted a maintenance training course on ultrasonics, with emphasis on the machines in the plant. That solved the problem, but now there's a new one. A precision measuring instrument (Vidigage) is due in the plant. And more training is in the works to help solve its maintenance problems.

Plant labs are notorious for their ability to bring good maintenance men to their knees. At Dow Chemical, the super-technical demands of the research department called for creation of a special course called "multi-trades journeyman course." It runs from six months to one year, depending on the man's starting skill. He learns all about research equipment. He crosses trade lines regularly in his new duties.

Other plants have problems, too, even though their products aren't complex. Take International Harvester Company's Louisville (Ky.) works. There, over 6000 kw. of high-frequency power for induction-heating of metal is generated. Much of this power is produced by vacuum tube oscillators. So the company developed a training program for the electricians who service this equipment. The equipment manufacturer provided the study material.

MORE CONTROLS, INSTRUMENTS

The complexity of the instruments in Du Pont's nylon plant at Spruance (Del.) merited a 14-week course for instrument mechanics when they transferred from the older rayon plant. The A. O. Smith Company

(Milwaukee) had a problem on controls for the plant's frame line. So the company put on a 20-hour program to help the plant's electricians understand them. These are examples of instrument and control problems—and training solutions—FACTORY found in many plants.

MORE COMPLEX ELECTRONS

It's no secret that most electricians can't handle a breakdown on electronic equipment. Result: Electronics is a major area of need for skill. And plenty of plants are meeting the need with training. North American Aviation (Los Angeles) sports a 200-hour course. Chrysler has a 96-hour indoctrination course for electricians, machine repairmen, maintenance supervisors, and process engineers. Pratt & Whitney Aircraft has two courses. One is a 165-hour basic course. The second (for outstanding students in the basic course) is a 126-hour course for trouble shooters and advanced electronics men.

MORE TRAINING OF ALL KINDS

Are maintenance men being trained in other, more familiar subjects? You bet they are. FACTORY found training in every maintenance field from hydraulics to horticulture; from air conditioning to plant heating.

And the course content is rarely slipshod. Pratt & Whitney's basic hydraulics course is a 100-hour affair. Chrysler's steam engineering course runs two hours per week for one year. Lockheed Aircraft's basic maintenance course in mechanics runs 20 classroom hours.

Pipefitters at one chemical plant spent eight weeks —full time—on training. A backlog of work was created as a result, but the men benefited enough from the training to clean it up with little difficulty.

HOW SUPPLIERS HELP

Manufacturers can give the customer real help in meeting his training needs. Bristol Company (Waterbury, Conn.) is an example. The company conducts a formal controls school for customers' maintenance men.

The school is held at the plant in Waterbury. It's staffed by two full-time instructors and 14 engineer-specialists from the company's development, production, and application departments. Classes are limited to 10, but the company runs the courses as often as needed to meet customer needs. It's free for the student, except that he must pay living and travel expenses. Most companies (Thompson Ramo Wooldridge, Cleveland, is an example) pick up the complete tab for this.

At International Harvester Company, suppliers provide much of the plant's study material. It's a common aid offered to companies. But Plant Engineer Gerry Scheyer of Adamas Carbide Corporation, Kenilworth, N. J., claims that suppliers are overwhelmed and amazed when he asks them for training materials. In almost every case they have files full of training help, and literally don't know what to do with it. There's precious little demand, apparently, for one of the best services any supplier can provide.

Some suppliers will come to the plant to help train the maintenance men. International Business Machines at San Jose, Calif., recently installed an electronic air conditioning system. (The plant is new.) A manufacturer's representative held maintenance training sessions with the crew chiefs during installation. But after some breakdowns, the company decided that the chiefs weren't able to carry enough of the training down to the maintenance craftsman level. The manufacturer's rep came back to the plant, spent two 7-hour sessions with the men themselves, and the trouble cleared up.

TRAINING FOR TINY PLANTS

All this is fine, you say. But what about my little plant. I can't afford a training program. Gerry Scheyer (Adamas Carbide) has the same problem. His maintenance department consists of four men: a group leader, and 1st, 2nd, and 3rd class maintenance men. Gerry insists he has no training program. But, in fact, he has a system that would put plenty of bigger plants to shame. Here's what he does to build his tiny staff:

- He's careful in hiring. He has made up a few simple tests of an applicant's knowledge of basic physical laws. In hiring a man to specialize in electrical problems, for example, he devised a three-question test on wiring motors and a three-way light switch. He hired a man who got two out of the three diagrams right.
- He gradually breaks each man in on new jobs. For example, the 2nd-class man may have no electrical training. But he's given an assignment to wire a control panel, just to break down his awe of the new field. This first assignment is completely planned in advance, like a hi-fi amplifier kit for a home hobbyist. He just follows the numbers. He does the entire job himself. It's almost always perfect. This stimulates the man's interest. He is then given tougher assignments. Eventually he's able to plan his own work.
- He occasionally buys a technical book for one of his men. He makes it a present. This isn't a planned, mass-production operation. It's individual. The selections are based on each man's individual needs.
- He makes up maintenance manuals from suppliers' information. He claims practically any subject in the universe is covered in suppliers' manuals. And the suppliers are more than glad to oblige a request.
- Tiny Adamas Carbide has a library. It's in Gerry's office. Made up of free and purchased technical books.
- Homework isn't unheard of among Gerry's men. He often introduces a problem, then leaves the man alone to work out the solution at home or in his free time.
- New equipment is ordered with two stipulations. First, Gerry wants information on circuitry and other technical elements *before* delivery. Second, he wants three sets of instructions instead of one. There's a set for the group leader, the library, and Gerry.
- Salesmen, service representatives, and supplier-engineers are the plant's chief training tools, according to Gerry. He encourages them to call, and go right out into the shop to talk with the men themselves. Says he, "Suppliers are a wonderful source of information. It's wrong to bottle up the information in the plant engineer's office."

Finally, Gerry says this about small or large plant maintenance training: "Coach the men constantly. Let them make mistakes. If a man isn't free to err, he can't be expected to learn to work on his own."

Turn the page

Training problems plague all plant men. Here are answers from 40 plants.

LINE MANAGERS TRIGGER TRAINING

Only the line maintenance manager knows enough about his operation to realize when the skills of his men aren't in tune with the job's requirements. The training or personnel departments didn't initiate courses in any of the plants where FACTORY found a good maintenance training record.

Dow Chemical Company is an example. Here's the three-part procedure the company follows:

(1) Line supervision requests training.

(2) They and men from the education department sit down and work out the initial training agreement. They work out course outlines, qualifications, progressions, grades, and scheduling.

(3) The union is called in to help settle on the final write-up. Sometimes the shop steward alone sits in at this step. Sometimes the shop committee hears the plans prior to final drafting of the program.

PLANNING—TOO MUCH CAN BE BAD

Pratt & Whitney Aircraft has a system similar to Dow's. Training requests almost always originate with the line organization. The training department carefully surveys the situation to determine if training is the real need, then plans a program.

Where Pratt & Whitney really stands out is in its views on the hazards of planning training rigidly in advance. Instead of a rigid schedule for each subject, the training periods, methods, and techniques are permitted to vary depending on the group's success in learning. In effect, the trainer gets a budget of time and method for training. And he's permitted to vary from the budget to accomplish his objective as he finds it necessary. Trainers who have previously been schoolteachers have difficulty fitting into this pattern.

Says one P&W training supervisor, "Former schoolteachers want to administer training. And we learned long ago that it just doesn't work. Some groups learn faster than others. Some instructors get a point across faster than others. And sometimes we frankly make wrong estimates in our planning for training. Our management, fortunately, lets us do our training within a set of limits, rather than on a strict schedule."

SHORTER TRAINING TIMES ARE BEST

Inland Manufacturing Company (Omaha) decided to do regular training on a technical level. The courses were first set up on a once-per-week basis. Employees went for six hours of training, on their own time, during their day off. When the schedule was changed to two days per week (two evenings or two mornings), three hours each session, learning went much faster. The new schedule was a little harder to maintain, but it worked out better for everyone.

Inland's experience is echoed by most of the plants that do maintenance training. Long hours in the classroom just don't work out. Students' attention spans, no matter how interesting the subject, simply can't stand up under prolonged classroom work. Generally, two hours seems to be the maximum time a trainee can keep his learning at a fever pitch. After that, the breaks need to be more frequent, and the learning slows down no matter what techniques the instructor uses to bolster interest. Republic Steel holds most classes to less than one and one-half hours.

SMALL CLASSES ARE BEST, TOO

Republic Steel's class size limit is 18 men. Most classes there are held to less than 15. The reason is an obvious one: Large classes don't pay off as well, in student learning, as smaller ones. And the biggest cost element in maintenance training—as in all other training—is the cost of the trainee's time. Many plant men fail to realize that cost of equipment, classrooms, and training personnel are minor compared with the cost of the trainee's time in class.

Dow Chemical goes even farther. Classes run from one to ten men. Ten isn't a firm limit. The size is determined by the demand for training, and the type of training needed. But the company's average class has five men in it.

There are exceptions to the general rule of small class sizes, of course. Inland Steel claims a usual enrollment of about 35.

EQUIPMENT: ALL KINDS

The successful trainers of maintenance craftsmen seldom do the job without proper tools. Lockheed Aircraft, for example, has this inventory of training equipment to make the job easier and better:

6 overhead projectors
4 slide projectors
1 opaque projector
5 motion picture projectors
2 tape recorders

Students at Republic Steel's classes find themselves in classrooms equipped with comfortable, semi-upholstered chairs, arranged four or five to a table. They are supplied with scratch pads, and pencils for note taking. Their room has all kinds of visual equipment available, in addition to the usual blackboard.

YOUR PLANT: A NATURAL CLASSROOM

In many assignments, RBB (B. W. Berenschot Company) insists on a budget of production time to aid in training maintenance men. This is on the logical assumption that a man can't learn about a complex special machine in the classroom. At least he can't learn *all* he needs to know. RBB deliberately fouls up equipment in the middle of a process, intentionally creates scrap and rework. The sensible reason for this seemingly senseless

lot of trouble is to train men to make repairs when the trouble can be scheduled. Later, unscheduled breakdowns will be of shorter duration.

Plant Maintenance Manager Max Schmidt of IBM, San Jose, feels, as RBB does, that the plant is one of the best training aids available. Says he, "The personal touch—on the plant floor—is better than beating your gums in the classroom."

Say a new, complex relay is about to be installed at IBM. The electricians that will work with that job might receive two hours of classroom instruction in advance. Then they go out on the floor and watch the relay being installed. During new-plant construction, Schmidt's men were under intensive training. Course material was made up from plans and specifications. The schedule of instruction was timed to coincide with the schedule of construction.

CAUSE-AND-EFFECT TRAINING

Luther Eschner is plant engineer at International Resistance Company (Philadelphia). Lu subscribes to a technique of maintenance training he calls "Cause and Effect Training." It follows the general framework of the practical plant problem training approach of RBB and IBM.

Concentrating especially on automation equipment maintenance, Lu has this to say, "Manuals that come with a piece of equipment are of very little value in day-to-day trouble shooting and adjusting. So you have to start with the machine itself and the product specification sheets if you want to train mechanics to maintain the equipment. The spec sheets are just as important as the machine itself, because problems often start with the raw material input, not the machine."

The mechanic in training should be allowed to completely disassemble and assemble the machine so that he can see for himself what makes the wheels go 'round. That way he learns what parts and cycles of the machine are related to possible errors in the finished product.

Lu gives this example to make his point stand out. In his plant a problem came up on one of the lead machines. They produce tinned copper wire with an over-all length of about two inches, and a diameter of 0.032 inch. The machine swedges the wire to give it a head about twice as large as the wire itself. This head must be held to close tolerance. And the problem was that it was varying above and below the spec limits.

The mechanic who was called to fix the machine reasoned that the feed must have been the problem. The head size is dependent on the amount of wire fed into the header for swedging. He tried several adjustments, but only got into more trouble. Then he gave up.

The maintenance man who finally solved the problem had been "inside" the machine often enough to know that variations in the diameter of the head could only be caused by worn bearings, a worn cam or worn cam follower. A cam follower with a flat spot was found, replaced, and the operation was back in production.

Lu Eschner suggests that incidents of this type be entered in a trouble-shooting manual. The manual simply lists the trouble that has already occurred on the machine, and the steps taken to correct it.

Another way to get double mileage out of trouble correction is to set up a bulletin board of parts that have been rejected, plus the reasons for rejection and the adjustment needed to correct the error. Kept on display in the maintenance department, this kind of display is a textbook on trouble shooting.

VISUALS: WORTH MANY WORDS

The parts boards used at International Resistance are a form of visual aid. The parts attract attention because they are things, not words. Illustrations such as motion pictures, still photographs, and drawings are effective for the same reason. Du Pont has drawings or reproduced photos in most of its maintenance training text material. And almost every plant with formal training uses visual aids whenever possible. Republic Steel uses 10 films on hydraulics alone. North American Aviation uses flannel boards, chart boards, view-graphs, filmstrips, motion pictures, and a large number of mock-ups of actual pieces of equipment. The mock-ups really work. And they're even better than visual aids because they employ the sense of touch.

Mock-ups are no stranger to the training field. They've been used for years in pilot training. Now they're finding their way into maintenance training, for the same reason most pilots start their blind flying training in a mock-up: Plants can no longer afford to make mistakes, even the first time, on maintenance of expensive, critical production machines—any more than a student pilot can afford to crash the first few times he tries blind flying. One company, Carmody Corporation, Buffalo, N. Y., now specializes in mock-ups. The company has done jobs for aircraft builders and has developed an all-purpose "mechanical principles trainer." Some maintenance men FACTORY visited are interested in special mock-ups of complicated equipment. They felt the cost would be quickly recovered.

HOMEWORK—YES OR NO?

For most plants, the answer is definitely no. Homework is out, because the training is for company benefit, held on company time, under company control. There are exceptions, of course. But they are rare.

Among the exceptions are a few companies that rely completely on home study for training. They encourage their employees to take home study courses. Often they pay for both tuition and materials. A directory of private home study schools is available from the National Home Study Council, 1420 New York Ave. N. W., Washington 5, D.C.

REPORT CARDS FOR STUDENTS?

There's no pattern to the practice on students' progress reports. Some plants have them, but most don't. The policy seems to depend on how well training is accepted by employees, how closely the line supervisor is tied into the training itself (if he's very closely involved, no report is needed), and whether the employee will be re-classified following successful completion of course work. One plant gives a pre-test and final test to see how much the student has learned. But this is more a test of the training than of the trainees. No plant gives a number or letter grade to trainees. One successful method for plants that want to grade trainees

is a periodic written report of one or two paragraphs, telling generally what the man's reaction to training has been, how he's doing, and what the instructor thinks his future potential is. It's a successful system for the plant that uses it.

CAN LOCAL SCHOOLS HELP?

The least advertised boon to maintenance training FACTORY found is the public schools. Almost one-third of the plants doing any maintenance training at all are being helped by the public schools in the plant area. Many rely entirely on the public schools for all their maintenance training.

The state education and labor departments in New York, for example, offered adult vocational courses in industrial electronics in 44 communities last year. In all, 6000 people registered in these courses. The state supplies classroom space, teaching facilities, and organizes the programs. A number of plants FACTORY visited made use of this service.

Wolverine Tube Division of Calumet & Hecla, Inc., started its program through the Detroit board of education. And Lockheed Aircraft's Georgia Division has a working agreement with the Cobb County (that's the plant's county) board of education. The county, under the provisions of the Smith-Hughes Act, provides vocational training for workers on their own time, and at their own expense. The training department is responsible for keeping tabs on how many employees need and want specific courses. The county provides instruction, and Lockheed usually furnishes the rooms. Most courses run 2½ hours, two days per week for 12 weeks. Registration fee is $3. Maintenance men have been strong for such courses as "Mathematics for radio men and electricians" and "Electronics."

A. O. Smith found that the local schools could help, too. But instead of the public schools, the company called on the Milwaukee Vocational School to aid in course outlines. Result was that the school set up a two-year course on electronics. About 25 of the company's electrical journeymen have completed the first year of the course. Another course of technical lectures was put on by vendors, and a University of Wisconsin (Milwaukee) faculty member.

Throughout the program, the company had top cooperation from its union. One course was sponsored by company and union. Half the sessions covered technical subjects, the other half were on union topics.

CHOOSING IN-PLANT TRAINERS

If the public or private schools are involved in a maintenance training program, they usually provide instructors. But who's the best teacher if you do your own training?

Of the plants FACTORY visited or contacted, only a few of the larger ones were able to maintain a staff of trainers technically competent to do maintenance training work. The vast majority relied on line supervisors and engineering personnel. North American Aviation looks for men who like to teach and have an aptitude for communicating. Even if the need is for a man with a specialized background, the company insists on a man with teaching potential.

At Republic Steel the instructors are foremen, heads of departments, or engineers. They are paid (for their training work) by the Human Engineering Institute, which does Republic's training work.

The Institute originally asked each of six superintendents to recommend two instructors and an alternate. In four of the departments the superintendent and assistant recommended *themselves* as instructors.

The training takes place after regular working hours. And the manager-instructors are paid for the instruction time only. Their own training (as trainers) and lecture development is done on their own time.

The Institute trained all potential instructors in three half-day sessions. The sessions helped the instructor understand his role, the principles of learning, the techniques that are useful in maintenance training. Each man held a sample session, then was criticized by the others present. Each was given a special "Handbook for Industrial Teachers" to aid him.

WHAT ABOUT THE UNION PROBLEM?

Discuss the question of training—or almost any other subject relating to the maintenance workforce—with a group of maintenance managers, and you're sure to hear someone say, "That sounds great, but *we've got a union.* Our hands are tied."

A few plants fall in the opposite classification. They are vigorous in their enthusiasm about union cooperation in maintenance training. For example, General Mills, Inc. (Minneapolis), praises the American Federation of Grain Millers. According to the company, the union has backed General Mills's plan and actively recommended that other companies in the field study the procedure. Company and union have signed a four-page addendum on their "Maintenance Selection and Training Program." It details its purpose, tests used, and advancement process for each grade.

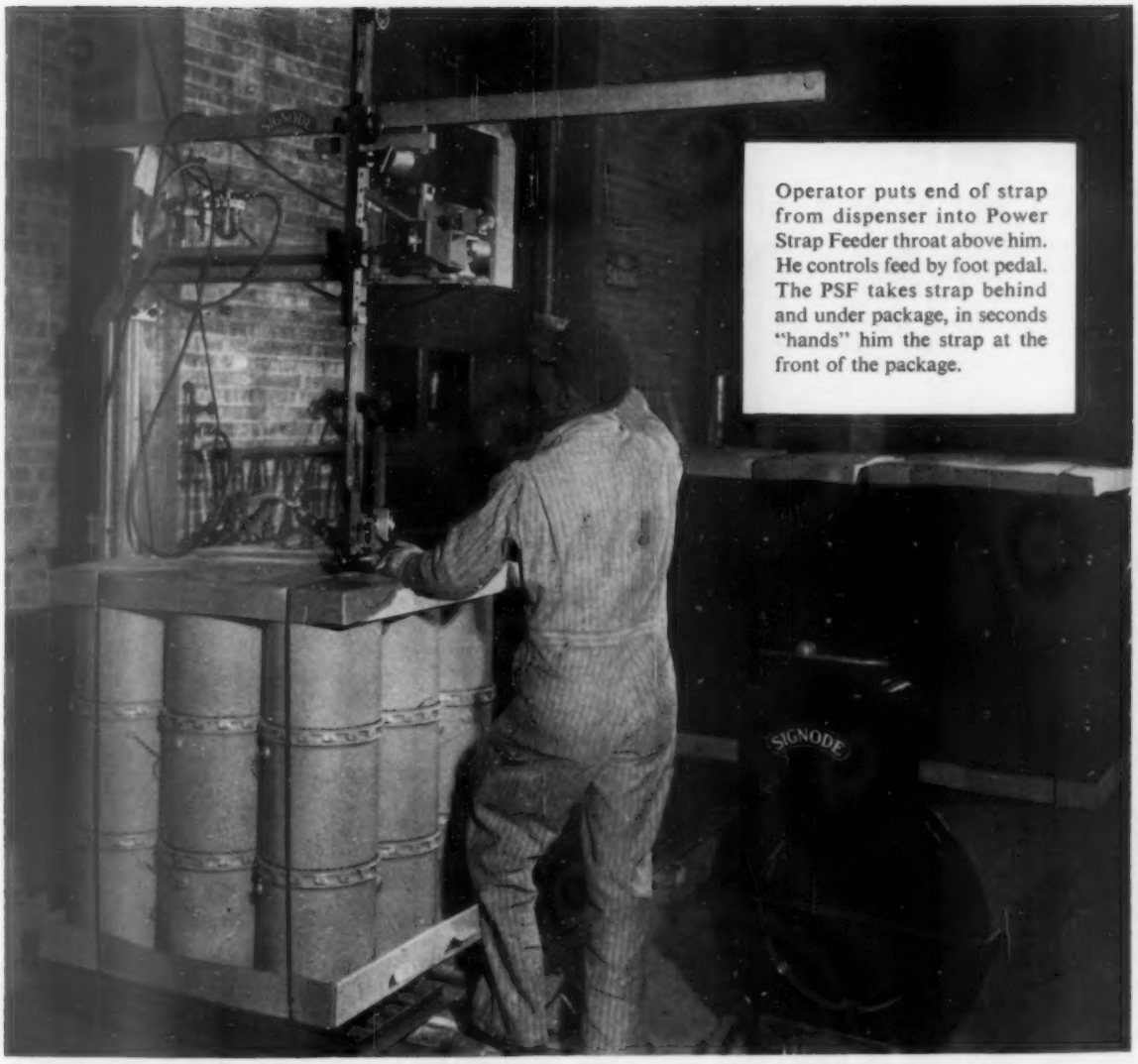
RBB (B. W. Berenschot Company), has yet to run into a serious problem from unions. Consultant Jo Bernard says:

"Americans cry 'union' unreasonably. We have no trouble, because we make it clear we are trying to update workers and set standards for future job assignments. Once the union people are convinced we are not out to cut back on existing manpower, we get nothing but cooperation. We do make it clear, however, that a trained man is not a crowned prince. He's not automatically entitled to better jobs."

Of all union problems, seniority gets more mentions than any other. It has a bearing on many maintenance problems, and training is no exception. Not much can be said about it that hasn't been said before. But the facts can be stated with remarkable clarity.

Here's what one manager had to say on the subject:

"Seniority is sound. To dispose of it would ruin morale. You're wasting time trying to change one of the big strengths of union organization. Your problem really originates in allowing older men to become less effective. They should have training in new techniques, refresher courses, challenging assignments. They must toe the mark or be downgraded."



Operator puts end of strap from dispenser into Power Strap Feeder throat above him. He controls feed by foot pedal. The PSF takes strap behind and under package, in seconds "hands" him the strap at the front of the package.

Simple, low cost way to unitize bulky loads

Cost control can be especially important in packaging big, light loads for shipment—like empty pails. The combination of a low cost Power Strap Feeder, adjustable for package size, with a Signode air-powered strapping tool that quickly tightens the strapping to a pre-set tension does the job for Vulcan Containers, Bellwood, Illinois.

This power feeder and tool combination is winning new and enthusiastic acceptance in nearly every industry.

It is fast. It saves one man on big packages in every case we know of because it eliminates a stand-and-wait helper's job. And it's simple, versatile. Cost: modest—saves enough to pay for itself from the start.

Let a Signode man get you the facts about your application, or send for more information from:

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For more facts Circle 419 on Reader Service Card

FACTORY EQUIPMENT NEWS

For more about these items, circle numbers on Reader Service Card next to back cover.

Low-Cost Pallet of No Return

Low-cost, expendable, lightweight, rugged. These are some major advantages of a new corrugated paperboard pallet you can use with any conventional material-handling equipment. The Econ-O-Pallet, costing less than $1, can be shipped without deposit or return agreement. It weighs under 7 lb., but lab tests show it can handle loads of over 28,000 lb. This far exceeds weight any pallet is called upon to carry, regardless of construction.

Wood veneer reinforcement over paperboard body gives pallet its high strength. Even high-moisture conditions don't impair it. "Lifting channels," also of wood veneer, are spaced to fit standard fork-lift tines, provide extra strength. No special handling equipment is needed.

Pallets are shipped "knocked-down" to user. In this form, they require little storage space, can be stacked at point of use, then assembled as needed. In less than a minute, a pallet can be set up with an inexpensive lightweight plastic jig. No staples or glue are required for the job.

Even when tiered, this sturdy pallet can withstand stresses of truck, rail, water, and air transportation. If necessary, it can be

strapped, glued, or taped to all types of loads. Its smooth paperboard surface protects product from damage by splinters, exposed nails, and other irregularities. *Materials, Inc.* (Circle 88).

89—Liquid Level Control, for outdoor water-storage tanks, follows true water level despite ice forming during sub-zero temperatures. "Winter-proofed" unit is protected by resistance heater to keep housing interior warm, thus maintaining water liquid. *Magnetrol, Inc.*

90—Mercury-Lamp Transformers, for low temperatures, indoor service, provide reliable starting down to –20 deg. of single- or two-lamp, 400-watt H1, H25, H33 lamps. Pendant mounting hubs for ¾-in. conduit and 12 knockouts permit fast installation. *Sola Electric Co.*

91—Manual Power Switch can be tripped electrically by a remote control or safety device. Combination switch-control interlock has interrupting capacity of 2000 amp. at 125 v. a-c. For use with malfunction detector, time and limit controls, etc. *Heinemann Electric Co.*

92—Motor Overload Relay provides complete protection. On slight overloads, alarm allows operator 5 to 10 min. to remove trouble. Unit gives normal delay tripping protection with medium overloads; instantaneous tripping for heavy ones. *Westinghouse Electric Corp.*

93—Routing System for conveyors automatically diverts tote boxes, cartons, etc., singly or in "train." Code-reading carton selectors control flow to processing stations. Dispatcher operates control console, which has preselected station keys. *Atronic Products, Inc.*

94—Lectro-Lok Duct Former rolls smooth, tight seams—perfectly made and even—at speeds from 18 to 30 fpm. depending on metal's thickness. Eliminates ear-splitting, time-consuming method of hammering ductwork seams closed. For 18- to 28-gage metal. *Millers Falls Co.*

95—Torque Drive Attachment, for ¼-in. and larger electric drills, increases power seven times for driving and removing screws, nuts, etc. Hand clutch controls power, assures safety. Adapter converts drill to fast power wrench. Also for masonry drilling. *The Stanley Works.*

Turn the page

DOW | **WEED AND GRASS KILLERS**

WEEDS ARE A HAZARD YOU CAN'T AFFORD!

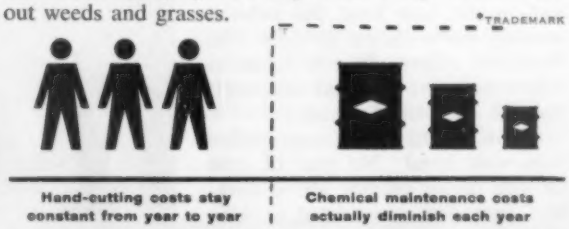
Spray them away with GARLON, the low-cost weed and grass killer

Weeds and grasses have taken over this siding, invading the switches, rusting the fences, creating a fire hazard. Under old-fashioned methods this would have meant weeks of work for an extra crew at prohibitive labor costs.

The modern, low-cost method–spray them away with Garlon*. And since Garlon can be applied anytime weeds are growing actively, you can do it at your convenience and spread your maintenance dollar over a longer period.

Garlon is easy to use, too. Simply add the required amount of water, mix, and you're ready to spray. Your own crews can do the job, or a professional contractor will do it very inexpensively. Spot re-treatment if needed, is just as easy and inexpensive.

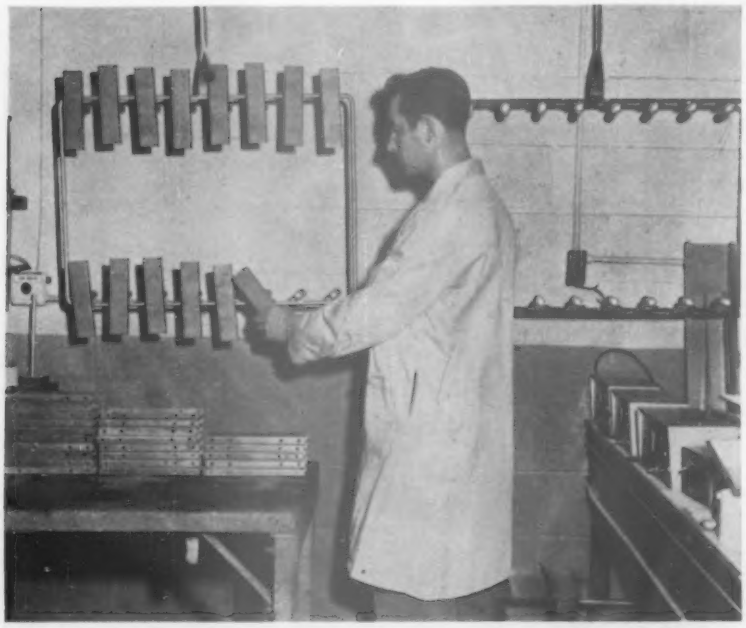
It all adds up to lower-cost control of trouble areas like fences, sidings, storage areas, drainage ditches, parking lots. And the cost gets progressively lower! Once you start a program of chemical vegetation control, you'll find fewer sprayings are required each year to knock out weeds and grasses.



For more information on modern chemical vegetation control write: THE DOW CHEMICAL COMPANY, Agricultural Chemicals Sales Dept. 207LO2, Midland, Michigan.

THE DOW CHEMICAL COMPANY MIDLAND, MICHIGAN

For more about these items, circle numbers on Reader Service Card next to back cover.



Fast Stick-up for Conveyor Parts

Magnets, not clips or hooks, hold parts to these racks moving from one production operation to another. They handle ferrous parts, stampings, etc., as large as car doors. Permanent and non-electric, they're welded to stainless steel frame and grip from both ends. Parts suspended from them can be dipped, sprayed, washed, coated, plated, or conveyed. No more drilling or punching of hanger holds in metal.

Easy-to-load Magna-Rax are for use individually or attached to overhead or monorail system. They adapt to a wide variety of shapes and sizes; resist rust and oxidizing; tolerate temperatures to 750 F.; take little storage space. *Eriez Mfg. Co.* (Circle 96).

Rubber Sanding Drum Follows All Contours

Picture a low-pressure tubeless tire with an abrasive band around the outer periphery. Mount it on a core, and presto, you have the inflated sanding drum shown at right. Its flexibility allows abrasive band to follow contours of metal and wood for fast, complete finishing job.

Drum, 8 in. in diameter, takes 9-in.-wide band. No part of core or side plates extends above abrasive, providing unrestricted working area across entire surface. Leakproof drum needs no adhesive or sealant to fasten to core. In 1200 or 1800 rpm., bore sizes 1¼ or larger, choice of spindle stands. *Nu-Matic Grinders, Inc.* (Circle 97).

98—Heating Element for electric furnaces is in one 63-in. piece with hot zone in form of spiral. For use at all element temperatures to 1575 C. (2867 F.). Has no joints to fail, is unaffected by furnace cycling, thermal shock. Hot zone from 4 to 40 in. *Morganite, Inc.*

99—Warning Alarm, with no electrical moving parts, can be used in hazardous locations. Sounds off loudly at 120 db. or can be tuned lower as needed. Several sounds are available and can be changed by substituting plug-in cards. For use with most voltages. *Lundell & Co.*

100—Pour-Portioner fits on 2-in. drum bungs to meter and feed light or heavy chemicals and slurries. Has precise metering valve; large porthole sight glass. Operates by gravity on light liquids; few inches of compressed or vacuum air on thick liquids. *Sterling E. Norcross Co.*

101—Two-Way Mobile Radio combines transistors, semi-conductor, and vacuum tubes to produce low-cost, low-maintenance set. In 10 to 30 watts, at $400 to $425. Transicom operates in 144- to 174-mc. band. Speaker directs sound to listener. *Allen B. Du Mont Labs, Inc.*

102—Spiral Air Hose has specially designed fitting that eliminates couplings, adapters, swivel joints. No-kink hose extends 23 ft., uses 200 psi. to operate blow guns, disk sanders, impact wrenches, etc. Retracts compactly, thus eliminating hose reels. *Samuel Moore & Co.*

Turn the page

NEW from DELTA

20" metal-wood *variable speed* BAND SAW

No matter what your cutting requirements —in the foundry, toolroom or pattern shop —this all-new Delta 20" Metal-Wood Band Saw gives you real on-the-job performance. Now—*for less than $900.00*—you can have the features you said you wanted most for greater accuracy and better cutting:

WIDE RANGE VARIABLE SPEED DRIVE . . . gives you a tremendous speed range—50 to 4500 FPM—for cutting everything from stainless steel to aluminum, wood and plastics. This versatility can't be equalled.

SCIENTIFICALLY DESIGNED BLADE GUIDES . . . ideal for heavy metal cutting because they furnish more "close up" blade support than conventional type guides. These new Delta blade guides are the key to better accuracy, straighter cuts, and longer blade life.

RUGGED FRAME CONSTRUCTION . . . features a massive, rigid internal frame with a modern fabricated exterior. Exclusive 3-point adjustability (wheels, upper guide and table) assures perfect alignment of key components.

In addition to these outstanding features you get a massive table with double trunnion support, convenient speed controls, plus built in chip blower *at no extra cost.*

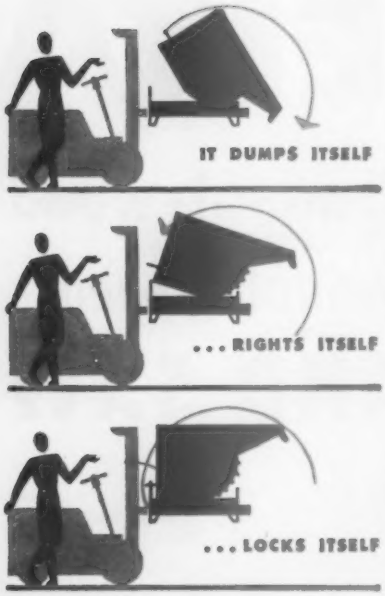
SEE IT AT YOUR NEAREST DELTA DEALER—he's listed under "TOOLS" in the Yellow Pages—or write: Rockwell Manufacturing Company, Delta Power Tool Division, 628B N. Lexington Avenue, Pittsburgh 8, Pa.

BLADE WELDER, including shear and grinder, shown on No. 28-462 Bracket mounted on 20" Band Saw for machine-side use. (Optional accessories)

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL



This hopper and your truck can cut handling costs 50%

It's a self-dumping hopper made for fast, efficient handling of wet or dry, hot or cold bulk materials, such as:

Scrap Metal . . . Cinders
Cullet . . . Hot Forgings
Punch Press Parts
Soybean Meal . . . Pickles

Hundreds of industries use thousands of them. Pick-up is swift and simple. Forks or platform of any standard lift truck slide easily into hopper underframe. Truck operator picks up loaded hopper . . . transports it to its destination . . . trips the latch . . . and the Roura does the rest . . . automatically.

They're strong . . . husky . . . made of 7/16" steel plate with continuous arc-welded seams. Also available in stainless steel or galvanized. Made in five sizes, ½ to 2 yard capacities, with live skids or a choice of wheels.

Standard models are available for immediate shipment from stock.

ROURA *Self-Dumping* **HOPPER**

WANT MORE DETAILS on how you can save money with Roura? Just clip this coupon... attach it to your letterhead . . . sign your name . . . and mail to

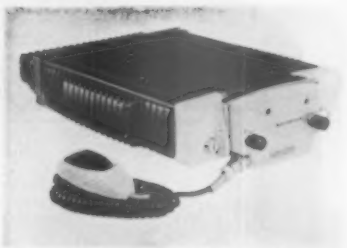
ROURA IRON WORKS, INC.
1423 Woodland Ave., Detroit 11, Michigan

For more about these items, circle numbers on Reader Service Card next to back cover.

103—Dust Hood, of rigid plastic, maintains dust-free conditions for critical laboratory, manufacturing, and inspection work. Air passes through filter at top, removes dust particles down to 0.5 microns. Pressure keeps out unfiltered room air. *Air Shields, Inc.*

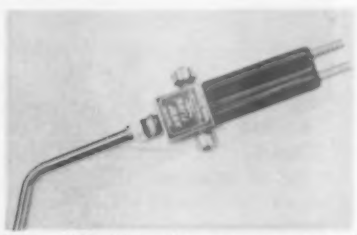
104—Motor-Load Indicator, for single or 3-phase, 50- or 60-cycle induction motors, measures useful or working component of load current. Gives accurate indication at light loads as well as full load. Range is 190 to 280 v., or 350 to 550 v. *Westinghouse Electric Corp.*

105—Sideloading Truck has twin crane booms that are completely independent of forks and can be easily removed. Booms and forks have same capacity (4000 and 6500 lb.). Load suspended from them is automatically carried at proper load center. *Otis Elevator Co.*



106—Two-Way Mobile Radio uses long-life transistors to achieve compact (3x13x17 in.) low-maintenance unit. Its 25- and 50-watt models (25- to 54-mc. band), and 30-, 60-, and 80-watt models (144 to 174 mc.) draw no more than 0.5 amp. while on standby. *Motorola, Inc.*

107—Crossover Bridge forms roadway across roads and rail tracks to eliminate ramps and detours. Push-buttons on either side activate an electrical-hydraulic power unit to position double-leaf decks. Deck is 8 ft. wide with 21-ft. span. Holds 25,000 lb. *Rowe Methods, Inc.*



108—Hand Torch separates gas and oxygen up to the burner face to produce steady sharp flame that won't blow out or be shaken out. No flashback, no internal burning. Operates at gas pressures of ½ psi.; oxygen, 1 to 2 psi. For soldering, brazing. *Bethlehem Apparatus Co.*

Turn to page 110

Hats off to the profit makers!

Maintenance departments are major profit makers. Here's why:

A 10% reduction in maintenance costs can result in a *4% jump in profits in the average plant*—according to latest Commerce Department figures.

Increasing numbers of cost-conscious maintenance men are adopting Organized Lubrication as one of the proven ways to reduce costs. As Texaco Lubrication Engineers have demonstrated time and again, an Organized Lubrication program can *cut direct maintenance costs as much as 10%!* (Other benefits: more dependable production, reduced lube inventory, simplified purchasing.)

Managers throughout the U.S. who have installed and evaluated Organized Lubrication programs can testify to the profit gained.

Texaco Lubrication Engineers can offer help and helpful material to start an Organized Lubrication program in your plant. Why don't you look into it? Call our expert—or write for a copy of our book: "Organized Lubrication . . . Major Cost Control Factor."

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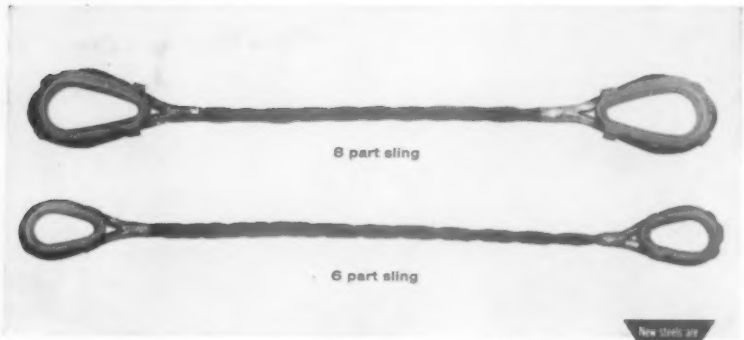
Texaco Inc., 135 East 42nd Street, New York 17, N. Y., Dept. F-132.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL



Now Tuffy covers all the bases...

NEW HAND-BRAIDED SLINGS

are added to the UNION line

Union Wire Rope Corporation, makers of famous Tuffy patented, 9 part, machine-braided slings, now bring you top quality hand-braided slings. Meet the new members of the Tuffy team:

The hand-braided 6-part sling provides wide bearing area; greatest single-plane flexibility; least strength loss under severe bending; high cutting and twisting resistance.

The hand-braided 8-part sling provides extra wide bearing area, gives extra flexibility in all planes, low strength loss in bending, highest resistance to kinking and spinning.

Like the entire line of Tuffy slings and hoist lines, these new slings are the product of extensive field and laboratory research. They're specially designed for extra strength and flexibility. Tight end-braiding keeps component parts equal in length so that each rope carries its full share of the load.

In these new slings you'll get quality backed by Union Wire Rope experience and integrity. And you'll get a bigger dollar valve in longer service life with greater safety.

Your Tuffy Distributor Will Help You Save Money on Every Sling and Wire Rope Use

He's the man to see when you're replacing or adding slings, hoist lines and wire rope. He is set up for fast service, backed by his nearby Union Wire Rope branch office and warehouse staff and factory engineers. Get in touch with him.

Tuffy® Tips

—on safe use of Slings and Hoist Lines

Professional Weight Lifters Work the Safety Angles

Here's a tip that could save an injury and absenteeism. The weight lifter's secret is proper leverage. Plus use of major leg muscles instead of back muscles. He never leans over to pick up the load. He squats down as near as possible to it. Lifting action comes from legs and thighs. If your workers must use muscles for some of the lighter lifting jobs, these points are worth remembering. But wherever possible—and always for heavy loads—use hoists and slings.

More Tips for Reducing Materials Handling Accidents

1. Teach your workers rated load factors. Warn them not to overload slings.
2. Use the right size hoist for every heavy lifting job. Don't put the load on muscles.
3. Show workers how to rig hoists properly and safely.
4. Inspect hoist load brakes often. Slipping or dragging brakes are a hazard.
5. Be sure to use the proper sling for the job. Don't assume that all slings made of wire rope are right for all lifting jobs.

FREE!
New Tuffy Sling Handbook

All about slings from A to Z, including types, dimensions and rated loads. Address **Union Wire Rope Corporation, 2234 Manchester Ave., Kansas City 26, Missouri.** Specialists in high carbon wire, wire rope, braided wire fabric, and stress relieved wire and strand.

UNION Wire Rope

Subsidiary of ARMCO STEEL CORPORATION

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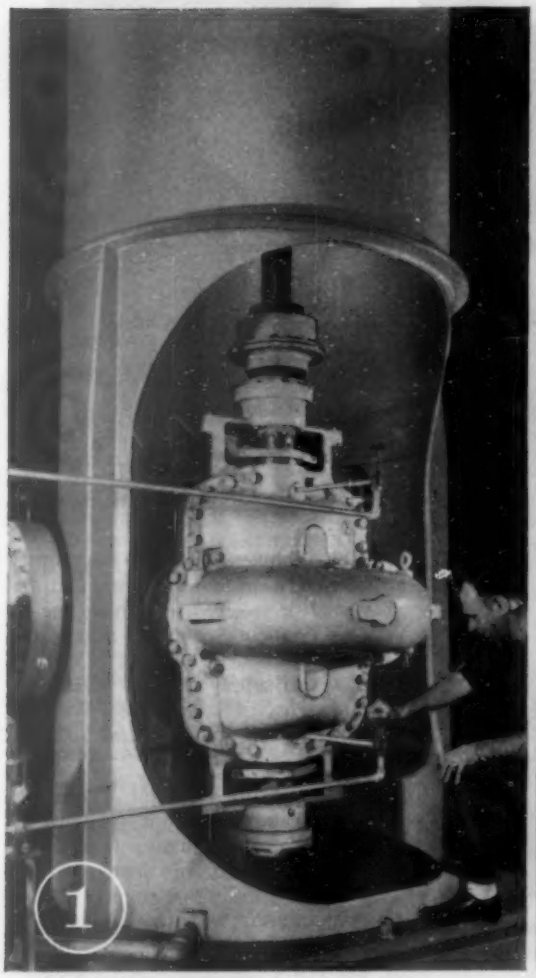
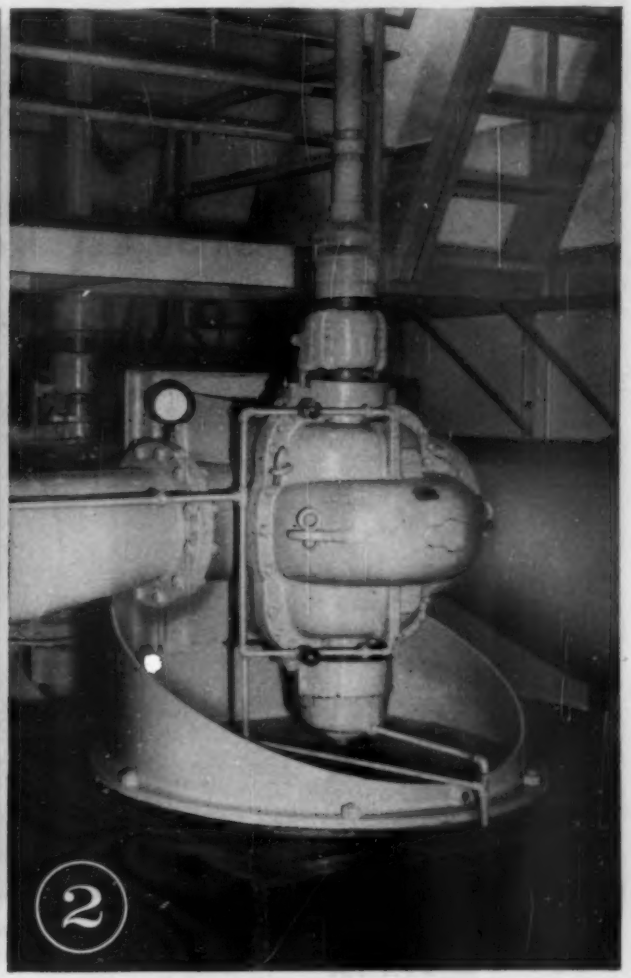
ALLIS-CHALMERS



Vertical mounting with barrel supporting motor provides for discharge at either 90 or 180 degrees to the suction.



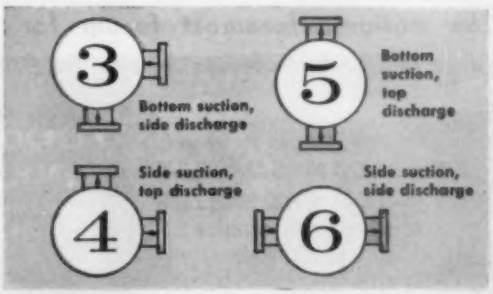
Mounted vertically, A-C pumps can be driven with motor on another floor — discharge at either 180 or 90 degrees to the suction.

Pinched for pump space?

Make the most of your space with an Allis-Chalmers centrifugal pump

Let the world's broadest centrifugal pump line lead you out of your installation space squeeze. Here's versatility that blankets every suction or discharge requirement — with vertical (see 1 and 2) or horizontal (see 3 to 6) mountings. Capacities run from a flow to a flood — to 250,000 gpm or more.

The size of the A-C pump line, the service and experience behind it, are without equal in industry. *For data, contact your A-C representative or distributor. Or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.*



A-1217

1960 TOOL SHOW and CONFERENCE

DETROIT ARTILLERY ARMORY
APRIL 21ST THRU 28TH

The nation's foremost forum for the advancement of scientific knowledge in the field of tool engineering

for rapid registration forms write:
AMERICAN SOCIETY OF TOOL ENGINEERS
10700 PURITAN AVENUE
DETROIT 38, MICH.

THE AMERICAN SOCIETY '60 OF TOOL ENGINEERS

FACTORY / EQUIPMENT NEWS

Begins on page 102

For more about these items, circle item numbers on Reader Service Card next to back cover.

109—Submersible Pump has adjustable turn-on control that can be raised or lowered to remove measured amounts of fluid, thus eliminating frequent cycling. Controls flow and supply of fluids in storage tanks, disposal and transfer systems. *American Crucible Products Co.*

110—Waste Material Collector quickly and easily traps wet powdery materials, and exhausts from 8090 to 22,300 cfm. of clean air. No moving parts, non-clogging. Maintains constant exhaust volume over wide range of operating conditions. *Eastern Cyclone Conveyor Co.*

111—Gravity Conveyor extends from 11 to 30 ft. for loading and unloading trucks, moving load into stacking areas, etc. Consists of a "nesting" of three 18-in. gravity wheel conveyor sections. Mounted on 5-in.-diameter casters, unit is mobile. *The Rapids-Standard Co.*

For more about these items, circle item numbers on Reader Service Card next to back cover.

112—Electric Hammer can hammer while rotating or not rotating, or drill without hammering. Eliminates man to hand-turn star drill when working on large holes. Two models, for ¼- to 1-in.-dia. and 1- to 2-in.-dia. holes. Cuts operating fatigue, saves time. *Skil Corp.*

113—Two-Way Mobile Radio, for communication between vehicles, or vehicles and fixed station, is transistorized. In 30- or 60-watt units; operates within 148- to 174-mc. band. Price comparable to tube-type units. Unique standby monitoring system. *Radio Corp. of America.*

114—Magnetic Limit Switch has no moving parts. Acts on proximity of two sensing elements rather than physical contact. For use where precise control of relative motion between two parts of machine is required. Output: 5 watts at 24 v. d-c. *Consolidated Controls Corp.*

Turn the page

Most Important Event in METALWORKING

1960 ASTE TOOL SHOW and CONFERENCE

530 exhibitors will be on hand to show and demonstrate more than 6,000 products . . . machine tools and attachments, precision control and inspection equipment, automation devices, cutting tools, dies, jigs and fixtures . . . everything, in fact, that's *new* in tools and tooling. It's your best opportunity to see, study, compare . . . under one roof, at one time . . . the most modern, scientific methods, processes and tools in metalworking.

Equally important, the Tool Engineering Conference, with its 36 technical sessions, 70 outstanding papers, offers you an opportunity to learn about and discuss the latest technical advances and developments in the science of tool engineering.

There'll be plant tours, too . . . a chance to see and study, in actual operation, product and process methods in the world's major center of high-volume production.

All of these scientific and educational attractions, and more, will bring more than 35,000 metalworking management, engineering and production men to the 1960 ASTE TOOL SHOW. Make sure you're one of them! Write or wire immediately for your rapid registration forms.

APRIL 21ST-28TH

DETROIT ARTILLERY ARMORY

write:

AMERICAN SOCIETY OF TOOL ENGINEERS
10700 PURITAN AVENUE
DETROIT 38, MICHIGAN

THE AMERICAN SOCIETY
'60
OF TOOL ENGINEERS

MULTIPLE SAVINGS...yours when you handle bulk materials with the LOAD LUGGER SYSTEM

Paper mill saves $6.00 a ton on cost of salt by buying and handling it by the Load Lugger container-load instead of by the bag.

Soap manufacturer reduces costs by handling and shipping vegetable oil in big tank-type Load Lugger containers—cuts handling time at loading and unloading points, too.

Salt, sulphur, soap, vegetable oil—solids, liquids, gases—you name it. The Load Lugger System will handle it at far less cost per ton, yard or gallon. You save on manhours, on equipment. One man, the Load Lugger driver, is all the manpower you need. One Load Lugger equipped truck picks up, hauls and spots or dumps numerous big Load Lugger containers.* Because one Load Lugger truck does the work of a fleet, you save on operating and maintenance costs—and Load Lugger containers require no licenses or insurance.

*Capacities 1½ to 16 cubic yards

Telephone collect, Fireside 2-0136 to learn about the savings you can make with the Load Lugger system.

INGERSOLL KALAMAZOO B-W BORG-WARNER

Borg-Warner Corporation

INGERSOLL KALAMAZOO DIVISION

1822 North Pitcher Street, Kalamazoo, Michigan, Telephone Fireside 5-3501

EXPORT SALES: BORG-WARNER INTERNATIONAL CORPORATION, CHICAGO

For more facts Circle 428 on Reader Service Card

FACTORY / EQUIPMENT NEWS

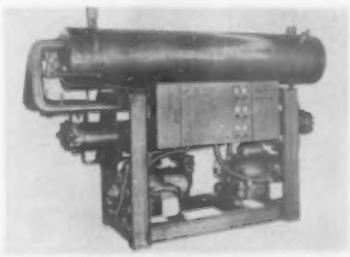
Begins on page 102

For more about these items, circle item numbers on Reader Service Card next to back cover.

115—Glass-Lined Pipe, with steel outer covering, can be easily cut to fit, and threaded in the field by maintenance crews. Glass lining is ⅛ in. thick. For use in corrosive environments, except hydrofluoric acid. In 1½ to 3 in. dia., 150 psi. *Pfaudler Permutit, Inc.*

116—Welding Cable Connector forms efficient contact by eccentric-locking or wedging action. Doesn't overheat or arc. Joins securely with twist of wrist. No moving parts. No-sag neoprene cover resists oil, grease. Two models for 1/0 to 4/0 cables. *Ampco Metal, Inc.*

117—Temperature Control, sensitive to within 1 deg. up to 600 deg., has bullet probe that can be located 100 ft. away from amplifier-relay cabinet and still read accurately. Controls loads to 10 kw. directly without separate magnetic contactor. *Edwin L. Wiegand Co.*

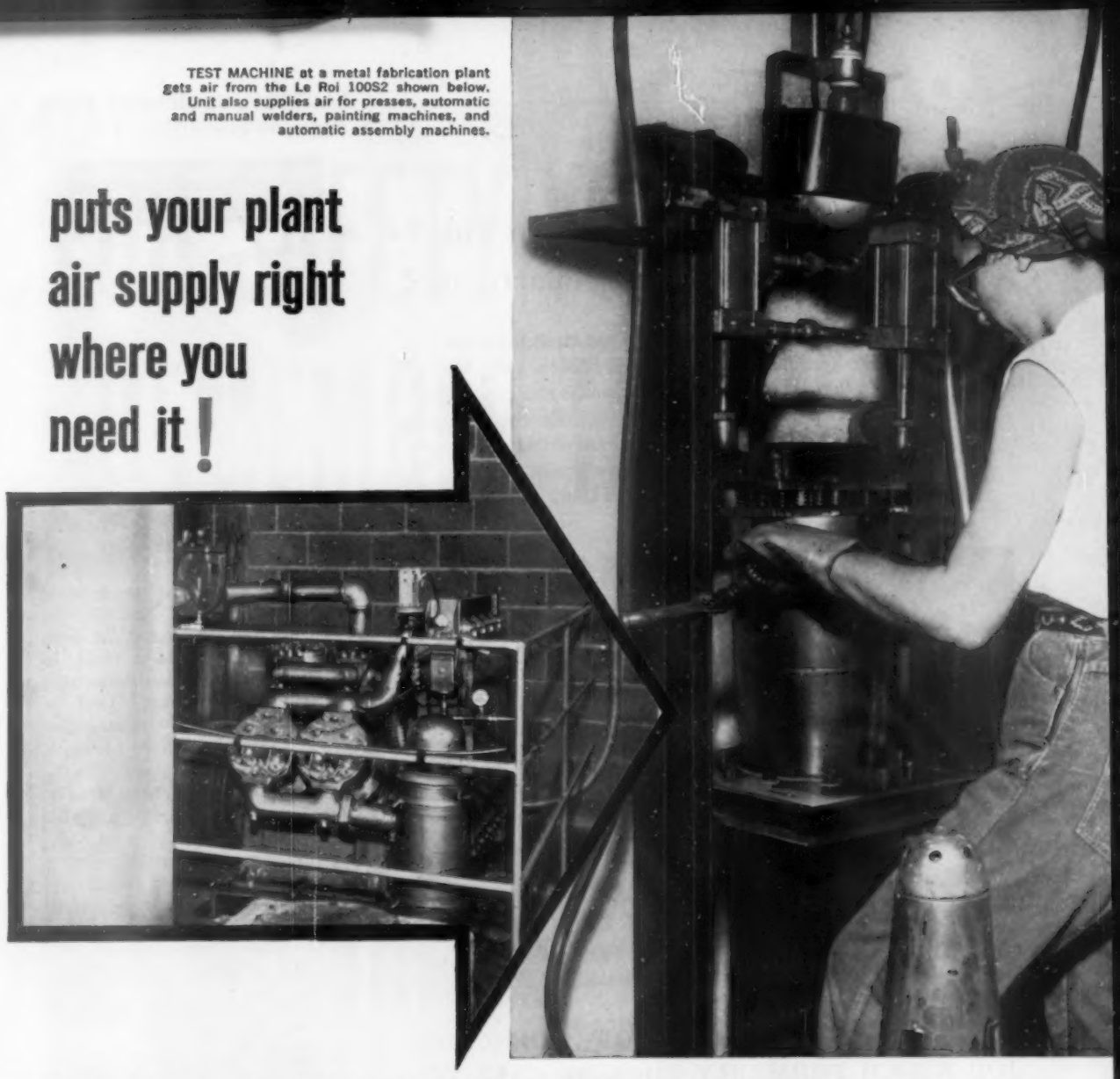


118—Water Chiller, for refrigeration and air conditioning, has twin hermetic compressors with individual motors. Capacities from 40 to 250 tons. If one motor fails, other maintains partial operation. Switch permits periodic changeover of lead motor. *Acme Industries, Inc.*

Turn the page

TEST MACHINE at a metal fabrication plant gets air from the Le Roi 100S2 shown below. Unit also supplies air for presses, automatic and manual welders, painting machines, and automatic assembly machines.

puts your plant air supply right where you need it!



LE ROI 100-HP STATIONARY COMPRESSOR

Trouble-free air-cooled LeRoi 100S2 delivers 450 cfm of air at 125 psi — yet takes up only 20 sq. ft. of floor space.

Any way you look at it, the Le Roi 100S2 two-stage stationary compressor is your best bet to lower your cost of compressed air.

It provides cool, clean airpower. And its compactness permits installation *near the point of use,* thus eliminating excess piping and costly waste of air. If you need more air, you just install more Le Roi S2 compressors — and you can still beat the cost of centralized air systems.

The electric-motor-driven 100S2 is easy to operate and maintain. Its Dual-Control permits either constant-speed or automatic start-and-stop operation. Air cooling eliminates plumbing and water line freeze-ups . . . permits indoor or outdoor installation. Balanced design reduces vibration and noise . . . extends compressor and motor life.

Put your compressed air system on a paying basis. Investigate the complete Le Roi line of unit-type and stationary air compressors — from ½ to 100 hp. Contact your Le Roi distributor, or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin. SC-05

LE ROI STATIONARY COMPRESSORS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

For more facts Circle 429 on Reader Service Card

RANSBURG

What Would Paint Savings Like This* Mean in YOUR Finishing Department?

Quality is all important in the production of fine Metalcraft furniture by George Koch Sons, Inc., Evansville, Indiana.

That's why they use the Ransburg Electrostatic Hand Gun to apply a uniform clear coating on their brass-plated furniture. The protective coating is baked on. Although the bulk of their present production is in the popular brass line, they still paint the metal furniture in a variety of colors with the Hand Gun.

Painting is CLEANER ... QUICKER ... CHEAPER *with the Ransburg Electrostatic Hand Gun.*

These chairs and table are typical of the Koch line of metal furniture.

*10 GALLONS OF PAINT NOW DOES THE JOB WHICH FORMERLY TOOK 30 GALLONS

On one item—a TV table—they formerly used 30 gallons of enamel to coat 1000 units by combination dip and air spray method. Now—with the Ransburg Electrostatic Hand Gun, they paint 1000 tables with only 10 gallons. And, they get a better, more uniform coating, too.

NO REASON WHY YOU CAN'T DO IT, TOO!

See how the Electrostatic Hand Gun can save time . . . paint . . . and cut costs in YOUR finishing department. Or, if your production justifies, it'll pay you to investigate Ransburg's automatic electrostatic spray painting equipment. Write for our No. 2 Process brochures which show numerous examples of modern production painting in both large and small plants.

RANSBURG

RANSBURG
Electro-Coating Corp.
Box-23122, Indianapolis 23, Indiana

FACTORY / EQUIPMENT NEWS

Begins on page 102

For more about these items, circle item numbers on Reader Service Card next to back cover.

119—Lift Truck for single-faced pallets comes in 2500- and 4000-lb. capacities. Fork lengths in both capacities run from 24 to 48 in., in 6-in. increments. Raised forks have 5¼-in. under-clearance. Good for short hauls in crowded areas. Lightweight (225 lb.). *Colson Corp.*

120—Two-Way Mobile Radio, completely transistorized except for two vacuum tubes, gives 0.4-mv. sensitivity. Uses standardized connectors, thus providing installation economy. Easy to service—all adjustments are made from top. Output: 12-watts. *Bendix Aviation Corp.*

121—Portable Pyrometer measures temperatures from –40 to 200 deg. to nearest ½ deg. Two-scale 150-deg. range is unique for measuring high temperatures. Interchangeable thermocouples make it adaptable to many kinds of measurements. Direct reading. *Illinois Testing Labs, Inc.*

Turn the page

FOR SAFETY YOU CAN SEE REMEMBER THE "V" FOR VISIBLE BLADES!

• The men who pull the switches will tell you what can happen when a switch, *believed* to be open —*isn't*. A lot of things can happen—and every one of them is bad. Personnel safety is in jeopardy. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

Doesn't it make sense to insist on Visible Blade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages? Evidently it does, because *Square D switches have never been out of first place in more than 50 years!*

They cost no more...why settle for less?

MAIL the coupon for latest Safety Switch Bulletin

Square D Company, Dept. SA-102
1601 Mercer Road, Lexington, Kentucky

Please send me your latest SAFETY SWITCH BULLETIN

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SQUARE D COMPANY

wherever electricity is distributed and controlled

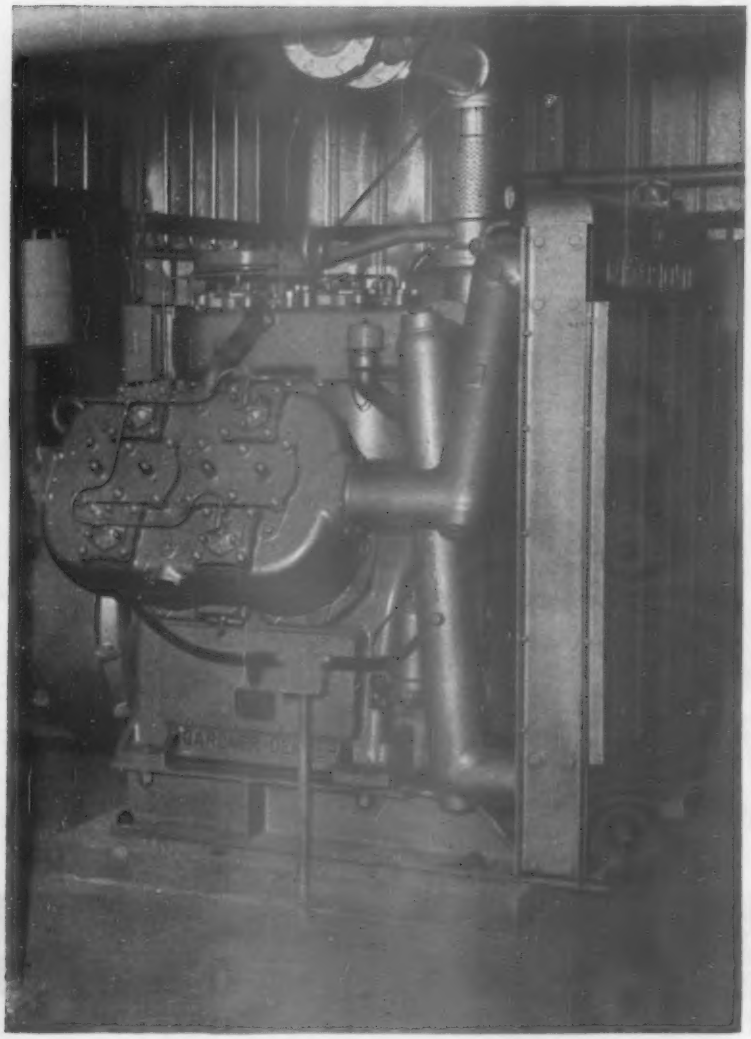
EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER DENVER

Here's the compressor package you can spot in any corner of your plant, hook up and put to work. Foundation specifications are modest. It's a champion on performance, too—noted for two-stage, water-cooled efficiency. And it's a champion with staying power. Years without the touch of a wrench is not unusual for Gardner-Denver quality WB machines. Capacities from 142 to 1150 c.f.m. displacement. Write for Bulletin WB-10, or call your local Gardner-Denver compressor specialist. Gardner-Denver Company, Quincy, Ill.

Space-saving champ

...money-saving winner



For more facts Circle 432 on Reader Service Card

FACTORY / EQUIPMENT NEWS

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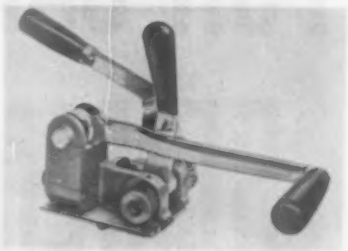
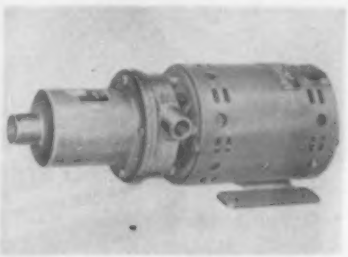


122—Strapping Tool tensions, seals, cuts off without separate seals or tools. Easy-to-handle, lightweight "Auto-Seal" uses banding to ¾ x-0.023 in. Continuous feed-wheel action moves tool into strapping while tension lever tightens. *Automatic Metal Banding Co.*

123—Temp-O-Larm triggers alarm when temperature in production equipment reaches overheat condition. For use with ovens, chemical production vats, etc. Audible or visible signal received at local or remote location. Two models monitor 6 or 12 units. *Walter Kidde & Co.*

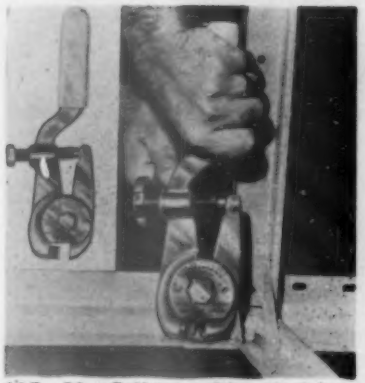


124—Solid/Liquid Pump, positive displacement type, has steel helical screw rotor as only moving part. This turns within fixed rubber stator with double internal helical thread. Provides steady flow (to 1200 gph.) of abrasive liquids or slurries. *Robbins & Myers, Inc.*

FACTORY / EQUIPMENT NEWS

Begins on page 102

For more about these items, circle item numbers on Reader Service Card next to back cover.



125—Nut Splitter, with swivel jaw, removes stubborn frozen and rusty nuts easily and quickly. Cuts nuts to ⅞ in. across flats without damage to bolt. Tip of power screw is hardened and tempered to prevent "mushrooming" under pressure. *H. K. Porter, Inc.*

126—Portable D-C Microammeter plugs into 120 v. and is ready for use without auxiliary amplification. No zero drift, no temperature errors over 20 to 120 F. range. Both left-hand or center zero are obtained by shifting lever. Range is to 50 microamps. *Esterline-Angus Co.*

127—A-C Power Package automatically provides emergency a-c power and light in case of line failure. Five models, with 60-cycle, 110-v. outputs from 40 to 150 watts, will illuminate a 70x90-ft. area with directional-type lamp. *Scranton Cellomatic Battery Corp.*

Turn the page

Time-saving team

moves heavy loads with ease

Spot foundry loads (up to two tons) quickly, easily, safely. Use this time- and muscle-saving team—a Gardner-Denver "Hoistractor" and air hoist. One man, with only one hand, controls all movements—keeps other hand free to guide load. "Hoistractor" is connected to hoist by a drawbar—rides the same beam. Hoist lifts and lowers . . . "Hoistractor" moves hoist *and* load back and forth along the beam. Hoist capacities from 150 lb. to two tons. Write for Bulletins 86-1 (hoists) and 87-1 ("Hoistractors").

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

For more facts Circle 433 on Reader Service Card

"Call FOSTER... they'll ship Switch Material PLUS"

Right! L. B. Foster Company will ship switch material "*plus*" any standard rail section (new or relaying), crane rail and accessories, and track tools —everything you need, at lowest possible costs. Foster is your fastest, most dependable source for every rail and track item required for industrial sidings or in-plant trackage.

One more "*plus*": the advantage of lower freight rates from Foster's nationwide warehouses and stocking points. To help select materials best suited to your job, call the Foster Track Specialist.

Write **L. B. FOSTER CO.** for new catalog FA-2

PITTSBURGH 30 • NEW YORK 7 • CHICAGO 4
HOUSTON 2 • LOS ANGELES 5 • ATLANTA 8

Faster From Foster
PIPE • PILING • RAIL

FACTORY / EQUIPMENT NEWS

Begins on page 102

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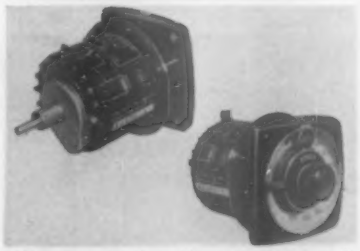
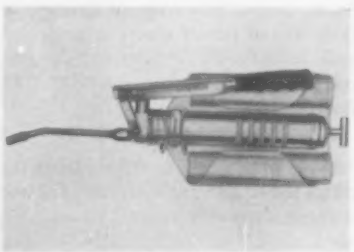


128—Revolution Counter automatically controls cutting of predetermined lengths of sheet material such as lumber, steel, textiles, fiberboard, plaster board, etc. Counts to 1000 rpm.; requires only a 1¼-oz.-in. torque for control of machine. *Automatic Timing & Controls, Inc.*



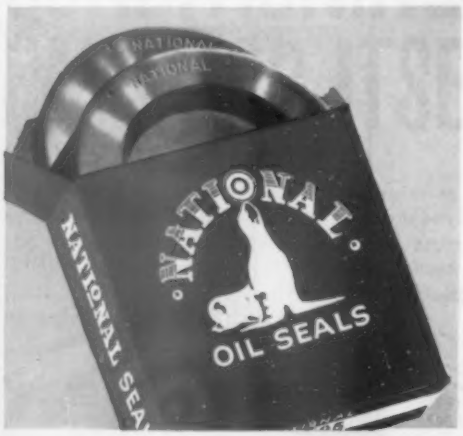
129—Grease Gun has latch pin in pistol-grip handle that shifts to supply either high pressure (to 10,000 psi.) or volume delivery of lubricant. Full pressure is possible with ¼-in. stroke length for close quarters work. Nozzle swivels 360 deg. *Lincoln Engineering Co.*

130—Fused Load Interrupter, for switching centers and service entrance, is low-priced compared to similar forms of switchgear. At 14.4 kv., it interrupts 500 mva. (44,500 amp.); at 4.16 kv., 250 mva. (60,000 amp.). Meets NEC requirements. *S&C Electric Co.*

Turn the page

Better products, *faster*, from your Bearing Specialist:

National Oil Seals lengthen bearing life... cut downtime losses... help hold production schedules!



Let your National Seal specialist set up a time-saving, workable service inventory for your plant

National Seals are always available for prompt delivery from stock, or by special order, whenever you need them. In many plants, maintenance men call in their National Seal specialist to set up a working service stock. It speeds repair jobs and gets machines back in operation quickly. It insures immediate replacement of new seals when the old ones are removed. And your National Seal specialist keeps your inventory constant for you.

National Micro-Torc, specially treated leather, and Syntech, synthetic rubber, guarantee uninterrupted protection for all your bearings. Your Bearing Specialist will gladly recommend the proper seal for longer life service. Call him today.

NATIONAL OIL SEALS

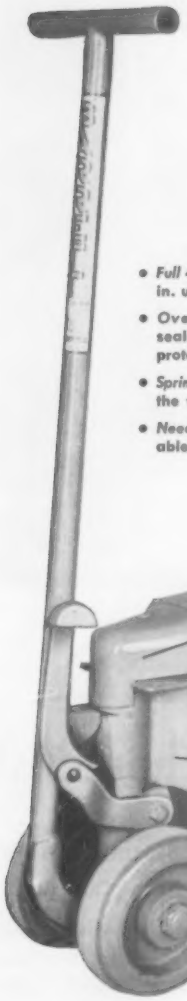
FEDERAL-MOGUL SERVICE

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 13, MICHIGAN

For more facts Circle 435 on Reader Service Card

BARRETT MODEL HX

Pallet Truck with proved differences



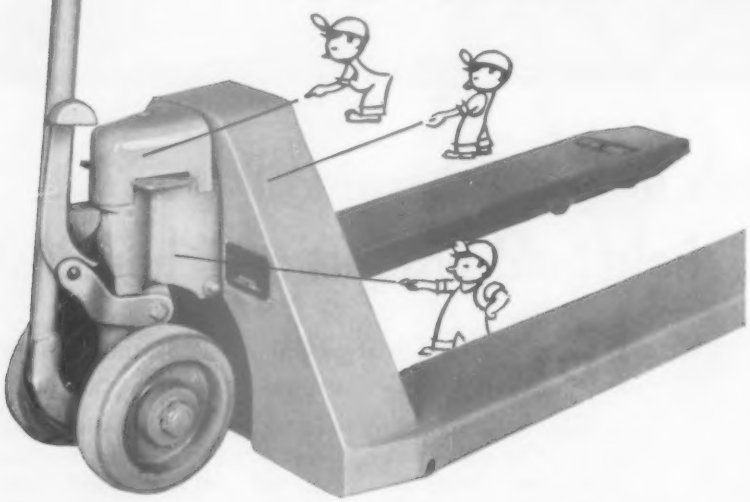
exclusive features make operation easier, increase maneuverability, add strength, cut in-use costs

Look at the time-saving hydraulic pump and ram on this Barrett Model HX pallet truck. See and test the annoyance-ending "flying saucer" entry wheels that guide forks quickly into pallets. Check the extra strong, all-welded ribbed frame construction that means money-saving durability.

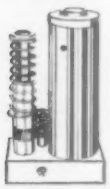
Add its other features and be convinced of its extra value:

- *Full 4½-in. lift*—multiple stroke—5⅝ in. underclearance, raised.
- *Overload by-pass valve*—factory-sealed, operates automatically to protect truck from damage.
- *Spring-controlled foot treadle*—out of the way, turns with 190° handle.
- *Needle-type lowering valve*—adjustable for perfect control.
- *Length only 13¾ in.*—fork stop to extreme front end for easy maneuverability in narrow aisles.
- *Lightweight but strong*—weighs under 200 lb. (with 48-in. forks).
- *Capacity*—loads 2000 to 3000 lb. Other models available in 4000- and 6000-lb. capacities.

WRITE FOR BULLETIN 5511

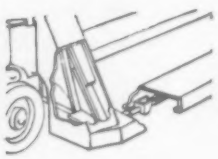


Ever see a time-saving feature like this hydraulic pump and ram package unit? Simply remove one bolt to change entire unit.



Exclusive feature with Barrett: "flying saucer" entry wheels skim into double-faced pallet—no pushing empty pallet ahead of truck.

Another Barrett exclusive: rugged, all-welded ribbed frame to withstand forces and stresses of hard, continuous use.



BARRETT-CRAVENS COMPANY • 616 Dundee Road, Northbrook, Illinois. Representatives in All Principal Cities • Canadian Licensee: S. A. Armstrong, Ltd., Toronto, Canada.

BARRETT

Materials handling equipment *engineered* to your job

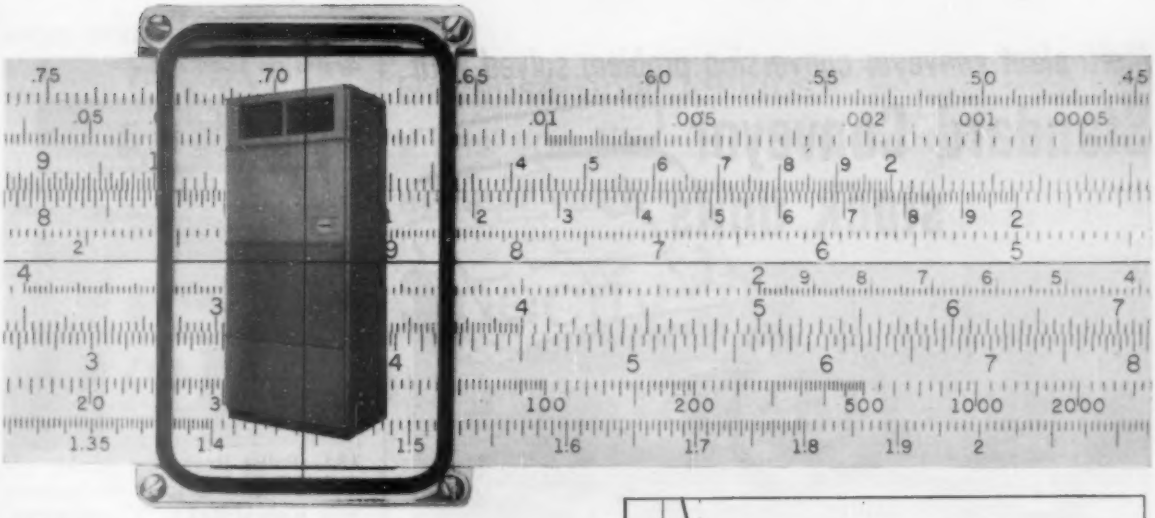
For more about these items, circle item numbers on Reader Service Card next to back cover.

131—Hopper Vibrating Attachment has shaft with spiders or arms centered vertically from base to top of any sized hopper. Eliminates all bridging and partial flow problems from dry storage by vibrating mass rather than vibrating hopper. *Vibra Screw Feeders, Inc.*

132—Solder Joint Valves, with a union bonnet and rising stem, eliminate distortion caused by mechanical strain or temperature changes. In ⅜- to 3-in. sizes, 125 psi. Parts, except body, are interchangeable with screwed end, 125-lb. valves of the same size. *Walworth Co.*

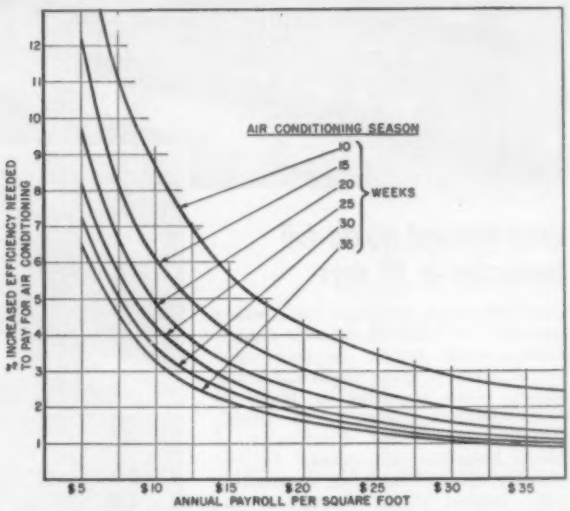
133—Lift Truck, 1000-lb. capacity, lifts to 160 in. Telescopic model, when closed, clears room doors easily. Synchronized 12-v. heavy-duty system gives rugged service. Other models in series include telescopic lift to 110 in. with 78-in. clearance. *Big Joe Mfg. Co.*

Turn the page



NEW COST-PER-SQ. FT. FORMULA SHOWS YOU HOW SOON

TYPHOON AIR CONDITIONING PAYS FOR ITSELF!



Send for details today! *Learn how you can calculate the exact percentage of increased production needed to pay full costs of owning and operating a Typhoon Air Conditioning System.*

You'll be amazed at how small an increase is needed – *approximately 2% for general factories,* depending upon the size of the area to be cooled. And records prove production *goes up 22%-28%* after Typhoon installation! Absenteeism drops! Errors are reduced! Labor-management relations improve!

Don't let financing problems stop you from finding out more! Typhoon's new installment and leasing plans offer you a choice of methods to save working capital – even gain tax benefits. Investigate today! Get Free Cost-Calculating Formula! *See Your Typhoon dealer or use the coupon below.*

TYPHOON
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TYPHOON AIR CONDITIONING DIVISION, HUPP CORPORATION 11-B
505 Carroll Street, Brooklyn 15, N. Y.

☐ *Please send cost-formula and literature.*
☐ *Have representative call for an appointment.*

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FIRM_____

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Multi-plant conveyor conversion problem solved with

Standard Conveyor stock units

Gould-National makes full conversion in 90 days

Gould-National Batteries, Inc., makes batteries for hundreds of sales organizations, each having its own color combinations in trade marks and brand names, some requiring as many as three distinct shades. And Gould-National, to insure distribution of fresh batteries everywhere in the country, manufactures in 16 strategically located plants throughout the United States.

Battery manufacture is a highly standardized, mass-production operation. Economical application of painted multiple colors on the cases posed real problems in methods and equipment. The conversion at Gould-National required equipping 16 plants simultaneously with painting equipment and conveying systems coordinated with existing production lines.

Methods engineers at Gould-National made the multi-plant conversion in the record time of 90 days . . . using Standard Conveyor stock units, including Handidrive power unit, with big savings in cost. And what do these engineers say about Standard Conveyor? "Best possible method for our type of operation!"

Illustrated are scenes from the St. Paul plant of Gould-National. Line was designed to produce 3,000 multi-colored batteries in 50 different sizes and colors per day.

When you have a materials-handling problem, call Standard — more than 50 years of conveyor engineering experience. Standard Conveyor Company, General Office: North St. Paul 9, Minnesota.

OVER 50 years of conveyor experience

Call the Standard engineer listed in your classified phone directory or write direct for Bulletin 309 —address Dept. G-2.

Standard

GRAVITY & POWER CONVEYORS

Sales and Service in Principal Cities

FACTORY / EQUIPMENT NEWS

Begins on page 102

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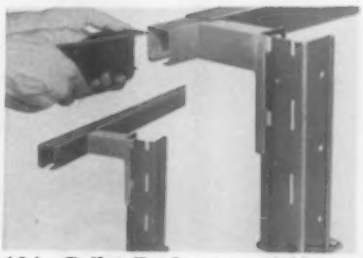


134—Pallet Racks are quickly assembled without tools or fasteners with Ridg-U-Rak's "T" connector. Provides safe, smooth surfaces with no projections. Rails slip easily onto T (top) to give snug fit (bottom). Verticals have flanges that lock with T at 4-in. intervals. *North East Co.*

135—Gage Block of stainless steel, with extremely hard surface, remains free from nicks, burrs, for long wear and accuracy. Reduces gaging costs in shop. Other features include corrosion resistance, micro finish to 0.09 in., no brinelling, uniform density. *The DoAll Co.*

136—Electric Hammer runs on 110-v., eliminates converters or rectifiers. Good for maintenance crews. Three models: Type E, 23 lb., with 1- to 3-in. drilling range; Type F, 19 lb., 3/16- to 1½-in. range; Type G, 15 lb., 3/16- to ¾-in. range. *Porter-Cable Machine Co.*

Turn the page

Because only Jenkins
gives you this 18 Point Protection
against valve repairs

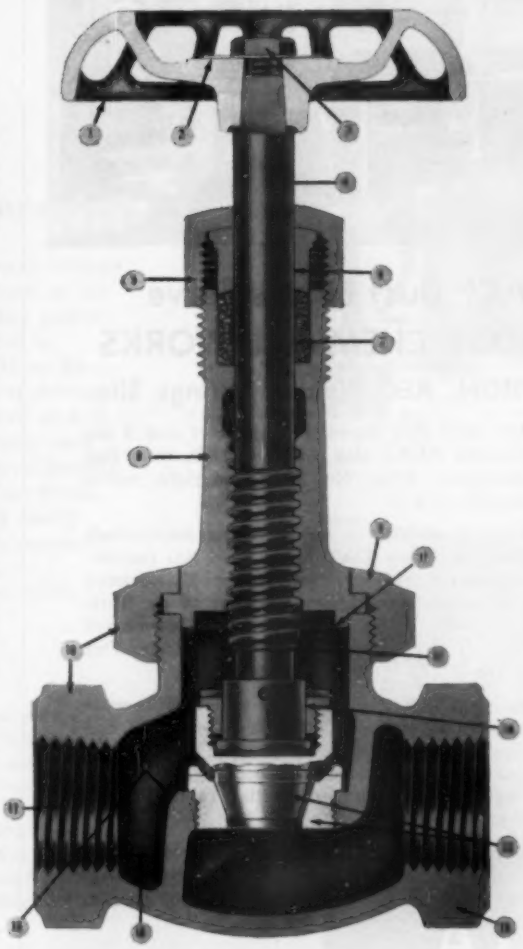
Specify JENKINS for PLUG TYPE Bronze Valves, too

THROTTLED STEAM with its destructive erosive effect on a valve seat . . . hard, seat-cutting substances like rust tubercles, boiler scale, pipe chips . . . such valve destroyers have little or no effect on a Jenkins Bronze Plug Type Valve. Jenkins 500 Brinnell Armor Seat defeats them.

There's much more to the durability of these valves than the seat. Jenkins gives you 17 *other* superior features that contribute to long-life and completely satisfying service. All are important to any valve user who wants maximum economy, and only Jenkins gives you all of them. Send for literature which gives full details about them.

Still more protection against valve repairs comes from superiorities which cannot be seen in any picture of a valve: The quality in the castings . . . the precision machining . . . the rigid inspection and testing which every Jenkins Diamond-marked valve undergoes.

You have many sound reasons for specifying Jenkins when the service calls for PLUG TYPE Bronze Valves. And you pay no premium for them. Write us or ask your Jenkins distributor for information folder.



1. PERFECT GRIP HANDWHEEL
2. VALVE INDEX PLATE
3. SECURE WHEEL NUT
4. SPINDLE OF HIGH TENSILE BRONZE
5. LARGE PACKING NUT
6. SELF-ALIGNING PACKING GLAND
7. DEEP STUFFING BOX
8. HEAVY BONNET
9. HUSKY UNION BONNET RING
10. UNIQUE WRENCH LUGS
11. CORRECT ALIGNMENT OF PARTS
12. BACK SEATING PROTECTS THREADS
13. PLUG AND SEAT RING OF CHROMIUM STAINLESS STEEL
14. LOCKNUT
15. FULL DIAPHRAGM-SHELL CLEARANCE
16. LIBERAL DIAPHRAGM WALL CLEARANCE
17. FULL LENGTH PIPE THREADS
18. EXTRA HEAVY BRONZE BODY

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES

Sold Through Leading Distributors Everywhere

JENKINS BROS., 100 Park Avenue, New York 17

Send folder No. 282-A describing Plug Type Bronze Valves

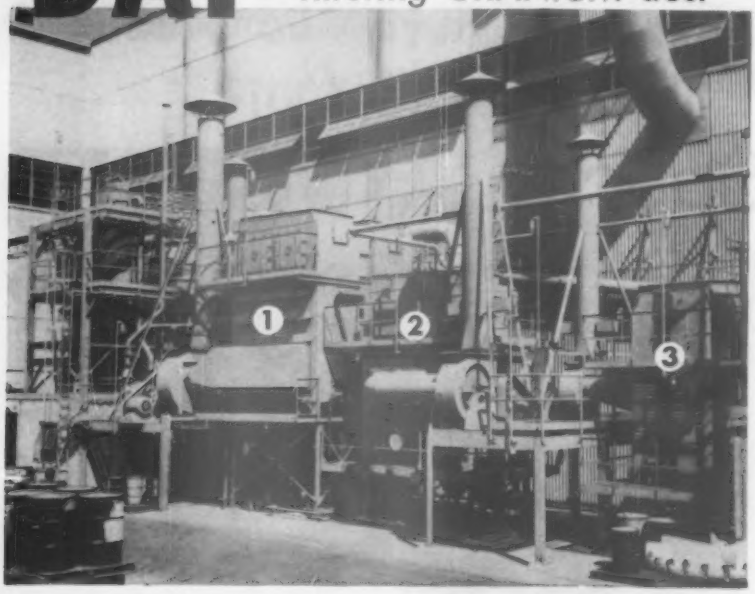
Name & Title.....

Company.....

Address.....

For more facts Circle 439 on Reader Service Card

DAY *plant proven dust control filtering URANIUM dust*



3 DAY "AC" Dust Filters Serve MALLINCKRODT CHEMICAL WORKS

URANIUM DIVISION, AEC Weldon Springs Site

Shown above are 3 DAY "AC" dust filters. Filters No. 1 and 2 are collecting magnesium fluoride (M_gF_2) slag dust and U_3O_8 from slag grinding and similar operations. Filter No. 3, on the right, serves to filter uranium tetrafluoride (UF_4).

Equipment with high filtering efficiency is an imperative requirement for an installation of this type. These DAY filters meet this requirement. They capture sub-micron particles with 99.99+% efficiency because they are designed around the Hersey principle of air filtration which uses felted filter media. Filter media porosity is maintained automatically and continuously by high velocity reverse jet air. This assures stable back pressure.

Throughout many industries DAY equipment is preferred because it's *plant proven*. It means DAY not only offers high efficiency and pure, clean air but higher recovery of valuable product. DAY "AC" reverse jet filters are also preferred because they occupy a minimum of space and provide higher air handling capacities (4 to 5 times higher than non-reverse-jet type filters).

For more facts about the services and equipment DAY offers, consult your DAY application engineer, and for complete facts about DAY filters write toDAY for Bulletins F-75 and G-579. They contain helpful planning information and air engineering data.

The DAY *Company*

SOLD in UNITED STATES by
The DAY SALES Company
858 Third Avenue N.E.
Minneapolis 13, Minnesota

MADE and SOLD in CANADA by
The DAY Company of Canada Limited
Rexdale (Toronto), Ontario, Canada
Fort William, Ontario, Canada

Representatives in Principal Cities

EXPERIENCE ENGINEERED . . . LABORATORY TESTED . . . PLANT PROVEN
Dust Control • Pneumatic Conveying • Bulk Storage
EQUIPMENT . . . SYSTEMS . . . INSTALLATION

FACTORY / EQUIPMENT NEWS

Begins on page 102

For more about these items, circle item numbers on Reader Service Card next to back cover.

137—Dust Collector, with high air/cloth ratio, installs in small space. Dust is centrifugally separated before reaching cloth. Rotating blow tube and roller support system needs no reversing mechanism or switches. In 1000-, 1500-, 2000-cfm. sizes. *Dustex Corp.*

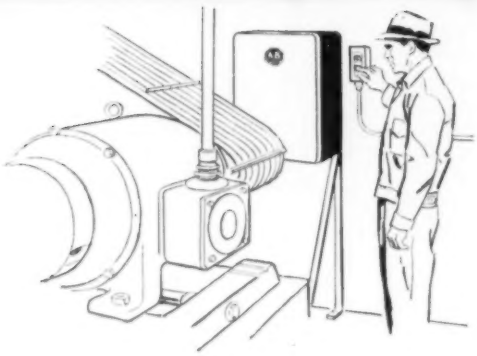
138—Hydraulic Transmission, 1½-hp. single or 3-phase motor, permits stepless variable speeds to 350 rpm. and instant reversing. Forward and reverse speeds can be either identical or different. Has neutral position, integral torque multiplier. *Roberts Mfg. Co.*

139—Beltable consists of flat belt conveyor with table top on adjustable legs for processing, piecework, assembly, sorting, inspecting. Adjusts transversely for work from one or both sides. In 5- to 120-fpm. speeds, 3:1 ratio; 75-ft. lengths. *Standard Conveyor Co.*

Turn the page

For more facts Circle 440 on Reader Service Card

For more facts Circle 441 on Reader Service Card ➤



WHEN REDUCED VOLTAGE STARTING IS A MUST

Only Allen-Bradley can provide all the answers

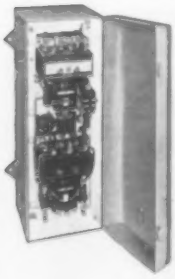
The Allen-Bradley line of reduced voltage starters makes possible a selection of the best starter, not only to meet the power company's requirements but also to provide the best starting conditions for the motor and the "load" that it drives.

The simple solenoid contactors in A-B reduced voltage starters have only ONE moving part—assuring millions of trouble free operations. And their double break, silver alloy contacts never need costly maintenance. Accurate, reliable overload relays protect motors against burnouts. Write for Publication 6088.

A-B QUALITY

Bulletin 746

Automatic reduced voltage starter for squirrel cage motors that should not be started on full line voltage. It employs autotransformer connected in open delta to reduce line voltage during starting. Adjustable timing relay controls starting period. Taps are provided on the autotransformer to adjust the starting voltage applied to the motor. Ratings to 300 hp, 220 v; 600 hp, 440-550 v.

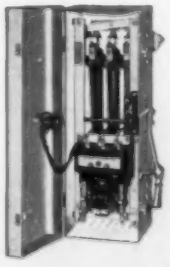


Bulletin 740

Graphite disc resistors are automatically inserted in series with the squirrel cage motor at starting, and they are automatically cut out after a predetermined time. Turning a single screw on the starter frame adjusts the compression resistors exactly to motor and load conditions for velvet smooth acceleration. Ratings to 200 hp, 220-440-550 v.

Bulletin 640

Where remote control is not needed, these graphite compression disc resistor starters provide stepless acceleration of squirrel cage motors. Operated by hand lever, the smooth starting of the motor is under the control of the operator. No-voltage and dependable overload protection is provided. Ratings to 200 hp, 220-440-550 v.



2-60-M

ALLEN-BRADLEY

Member of NEMA

Quality Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Positive Protection Against Phase Failure and Phase Reversal ?

Here is your answer!

The Allen-Bradley Bulletin 812 Type F, Type R, and Type RF relays provide positive protection against the hazards to men, motors, and driven machinery, resulting from phase failure and/or phase reversals.

The Bulletin 812 Style F phase failure relay employs a unique static sensing network that responds to all open phase conditions on a motor branch circuit and immediately removes the motor from the line . . . irrespective of the load on the motor (including no load), or the circuit arrangement. This relay even responds to hard-to-detect primary failures on a wye-delta transformer with ungrounded neutral. Furthermore, the five-cycle response prevents nuisance "drop-outs" from transient fluctuations.

The Bulletin 812 Style R phase reversal relay disconnects the motor from the line—whether it is running or not—when a phase reversal occurs anywhere in the system on the line side of the relay. Thus, it can be employed for a single motor, a group of motors, or an entire power system. In addition, the phase reversal relay prevents the motor from starting should phase failure occur while at a standstill—a vital feature for elevator applications.

The Bulletin 812 Style RF relay combines the elements of Style R and Style F relays for protection against both phase failure and phase reversal. All Bulletin 812 relays are inherently "fail safe." Send for complete information.

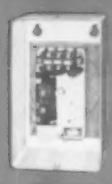
Bulletin 812, Style RF for Phase Failure and Phase Reversal

INDIVIDUAL RELAY UNITS AVAILABLE

For Phase Failure

Style F covers full load currents from 1.5 to 300 amp in 4 sizes. Coils for up to 600 v, 60 cycles.

For Phase Reversal



Style R made with coils for 110, 208/220, 440, 550 v for either 50 or 60 cycle operation.

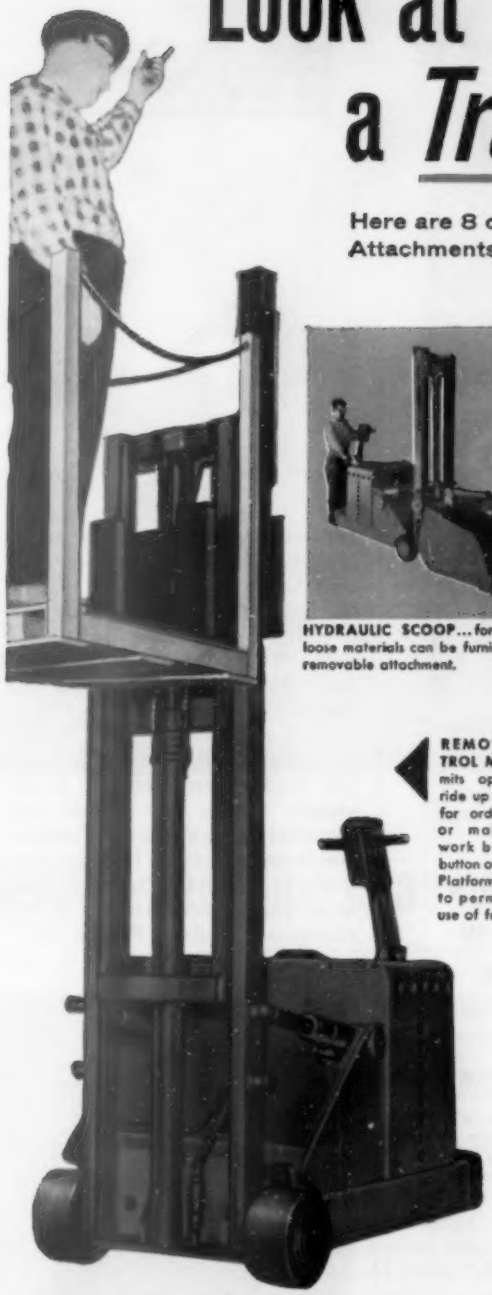
Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd.
Galt, Ont.

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

2-60-M

Look at all these things a *Transporter* can do!

Here are 8 cost-cutting ways Automatic's Standard Attachments can turn Transporters into Specialists



These specially designed standard attachments can add job flexibility to your Transporter Stacker. Now, a variety of jobs can be performed at considerable cost savings.

HYDRAULIC SCOOP...for handling loose materials can be furnished as a removable attachment.

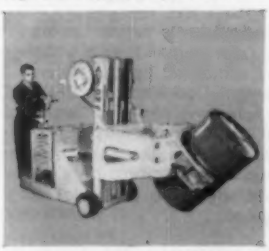
REMOTE CONTROL MAST permits operator to ride up and down for order picking or maintenance work by pushing button on carriage. Platform folds back to permit normal use of forks.

UTILITY CLAMPING DEVICE...Clamp arms can be attached to forks for handling cartons, etc. Clamp arms can be removed to handle pallets.

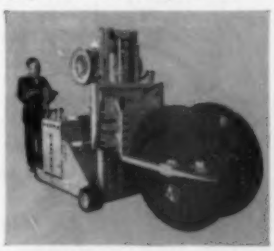
MECHANICAL GRAVITY DRUM DUMPER...Removable attachment to fit on forks.

GOOSENECK CRANE ATTACHMENT...for items too bulky or too irregular in shape to be palletized.

REVOLVING PAPER ROLL CLAMP ...handles rolls vertically or horizontally...revolves 360° right or left.



HYDRAULIC DRUM HANDLER... picks up and carries any standard drum ...180° controlled forward dumping.



CABLE REEL HANDLER...lifts and transports wire and cable reels.

First in Imagination...

First with Reality

AUTOMATIC

AUTOMATIC TRANSPORTATION COMPANY
Division of the Yale & Towne Manufacturing Company
39 West 87th Street, Dept. B-0, Chicago 20, Illinois

MAIL COUPON TODAY

Please mail me the data indicated below

- ☐ "Transporter Facts and Factors"
- ☐ Descriptive literature on special attachment for the following type of work.....

.....

NAME_____TITLE_____

FIRM_____

ADDRESS_____

CITY & ZONE_____STATE_____

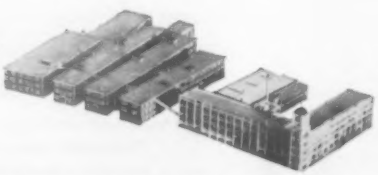
SOMETIMES IT'S CHEAPER TO LEAVE LIGHTS BURNING THAN TO TURN THEM OFF

The life of fluorescent lamps is affected, of course, by the number of times they're started. Assuming you had 10,000 40-watt preheat lamps in a room, by leaving them burning during a 15-minute lunch period, instead of turning them off, you'd save about $150 in a work year.

THERE ARE 7 DIFFERENT SHADES OF "WHITE" IN FLUORESCENT LAMPS

All seven basic "white" colors are needed to satisfy the color demands of a wide variety of commercial and industrial lighting users. The "cool" colors: Daylight, Cool White and DeLuxe Cool White are good for color matching. The "warm" colors: Warm White, DeLuxe Warm White and Soft White approximate the color of incandescent lamps and accentuate the reds. Plain "White" offers the best efficiency and is used where no particular color "atmosphere" is needed.

3,000 DIFFERENT TYPES OF LAMPS ALL PRODUCED IN 1 PLANT under 1 STANDARD OF QUALITY CONTROL



Champion has continuously produced top quality lamps since 1900. All research, development, manufacturing and test facilities are concentrated in one modern plant . . . all dedicated to provide you with light at lowest cost.

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT • *YOUR BEST BUY IN LAMPS*

For more facts Circle 443 on Reader Service Card

FACTORY / EQUIPMENT NEWS

Begins on page 102

For more about these items, circle item numbers on Reader Service Card next to back cover.

140—Surface Thermometer measures surface and immersion heat with handy 7-in. probe. Operator touches probe to object, reads heat directly on meter in range from –20 to +180 C., within ±1½ C. accuracy. Portable for field, production, lab work. *Ameresco Inc.*

141—Solids/Liquids Pump, positive displacement type, will handle viscous liquids and liquids with abrasives in suspension. Pulseless, non-foaming action. In three sizes, from 72 to 13,800 gpm. Handles latex, paper stock, paint, clay slip, shampoo. *Goodyear Pumps, Inc.*

142—Belt Elevator automatically speeds processing of heavy steel slugs 3¼ in. dia. by 5 in. long. Can be set to any feed rate with automatic bank controls maintaining continuous flow. Shuts off when track is fully loaded. Hopper capacity: 25 cu. ft. *Feedall, Inc.*

Turn to page 130

Tough installation! To provide ample clearance of 20 ft. Spang Pipe was installed at ceiling level, had to be "woven" through girders. Sizes ranged from ½" to 10".

"SPANG steel pipe is as near to perfect pipe as you can get"

says Mr. Ray Hilton, President and General Manager, Higham-Hilton Plumbing Co., Salt Lake City, Utah

Easy threading! Characteristic uniformity of Spang Pipe provided fast, accurate threading on the Wagner Bag job. All connections were either welded or coupled.

Wagner Bag Company Building heating, cooling and plumbing systems serviced by 2 miles of Spang Steel Pipe

"Spang Steel Pipe is a good, uniform pipe, easy to thread and bend, and has a smooth interior finish free of any obstructions," says Mr. Hilton. "About 90% of the pipe installed on the Wagner Bag Company job is exposed; it makes a good, clean appearance.

"We used Spang Pipe on this job because of our past experience with it, and because we could get good delivery when we needed it. It gave us a smooth, trouble-free installation. We expect it to provide good service for the life of the building. I think it's one of the best products on the market."

For new construction, renovation or routine maintenance, you can't beat Spang Steel Pipe!

It's quality-controlled in manufacturing to provide uniformity throughout . . . tested and inspected to assure top-quality performance at the job site and in service . . . proven by thousands of installations. Your Spang Distributor can provide fast service on your order. Give him a call. Make it Steel Pipe . . . Make it Spang!

Architect: Carpenter & Stringham, Salt Lake City
General Contractor: Tolboe & Harlin, Salt Lake City
Plumbing Contractor: Higham-Hilton Plumbing & Heating Co., Salt Lake City
Spang Distributor: Wasatch Plumbing Supply Co., Salt Lake City

SPANG CW STEEL PIPE

THE NATIONAL SUPPLY COMPANY

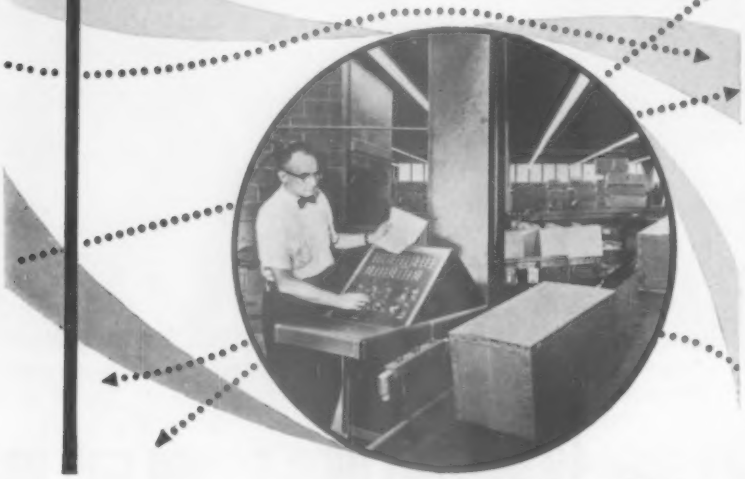
Two Gateway Center, Pittsburgh 22, Pennsylvania

Subsidiary of Armco Steel Corporation ARMCO

For more facts Circle 444 on Reader Service Card

MECHANIZE... PROFIT-WISE!

WITH LAMSON ENGINEERED CONVEYOR SYSTEMS



One man at Master Control Panel regulates the network of engineered conveyors.

You cut production time and the unnecessary handling of materials to the bone with the help of LAMSON engineers. They are specialists in developing materials handling systems that truly increase the capacity of your present buildings and dramatically increase the productivity of your present equipment.

There are more LAMSON custom engineered conveyor systems in successful operation today than any other kind. They are being serviced throughout their life by the same LAMSON field offices that initially analyzed the problem, proposed the solution and supervised the installation.

As a result of this complete, professional service you will find many of the finest nar.es in industry among LAMSON installations. During the past 75 years LAMSON has been active in almost every field, yours included, and perhaps even in divisions of your own firm. LAMSON can cut costs; speed production; increase your profits.

If you have a materials handling problem, write LAMSON today for our conveyor catalog and the name of your nearest LAMSON Field Engineer. Or, simply clip this advertisement to your letterhead and mail to:

PIONEERS *the Conquest* OF INNER SPACE

LAMSON

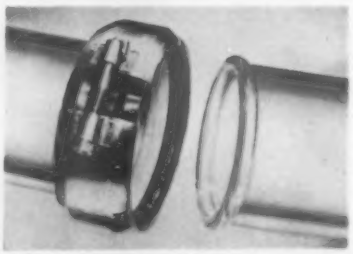
LAMSON CORPORATION

203 Lamson Street, Syracuse 1, New York

PLANTS IN SYRACUSE AND SAN FRANCISCO • OFFICES IN ALL PRINCIPAL CITIES

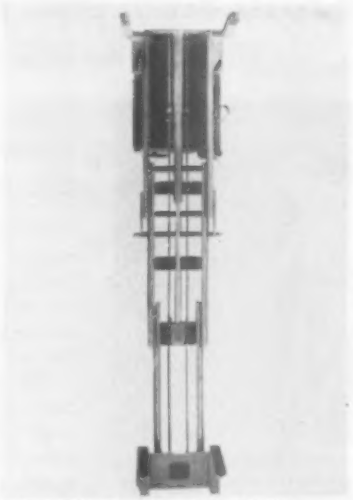
Manufacturers of Airtube® (Pneumatic Tube Systems) • Integrated Conveying Systems • Pallet Loaders • Selective Vertical Conveyors • Bookveyors® Clinical • Trayveyors® • Food Service Systems • Blowers and Exhausters • Exidust® Central Vacuum Cleaning Systems • Dryset® Air Vacuum Systems

For more about these items, circle item numbers on Reader Service Card next to back cover.



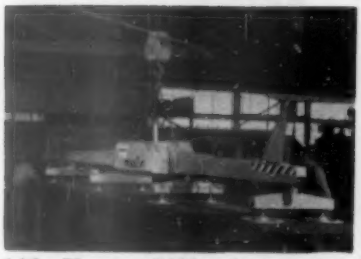
143—Glass Drainline system has simple, one-piece couplings for quick, permanent compression joints. Cuts installation time and costs, eliminates failure from corrosion or joint leakage in disposal of chemical wastes. Installs above or underground. *Corning Glass Works.*

144—Elevator Door Operator provides smooth door starts, slowdowns and positive jar-free stops through dynamic control. Uses d-c motor to drive helical gear train transmitting vertical motion through ball screw and ball-bearing. *Harris Preble Fire Doors, Inc.*



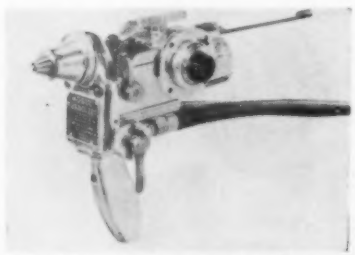
145—Lift Truck, with Tri-lift mast, permits extra-high stacking to take advantage of warehouse space. Tier loads to 180 in. Operates in 6-ft. aisles, through 7-ft. doors. Capacity, 3000 lb.; full free lift to 48 in.; 24-v. battery-powered. *Lewis-Shepard Products, Inc.*

For more about these items, circle numbers on Reader Service Card next to back cover.

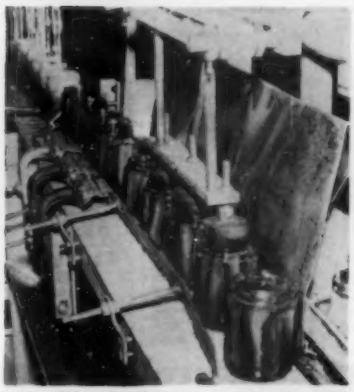


146—Vacuum Lifting System picks up rough objects (like concrete) or glass-smooth objects with complete safety. Emergency tank maintains sufficient vacuum in case of power failure—no slippage. Pads, in sizes to 25 in. dia., hold up to 2000 lb., depending on size. *Whiting Corp.*

147—Electrical Connectors come in new 5-wire line design for 4-wire applications needing added equipment ground. Units include male and female receptacle with metal housing; an armored cap and body. Ratings: 30 amp., 600-v. a-c; 20 amp., 250-v. d-c. *Harvey Hubbell.*

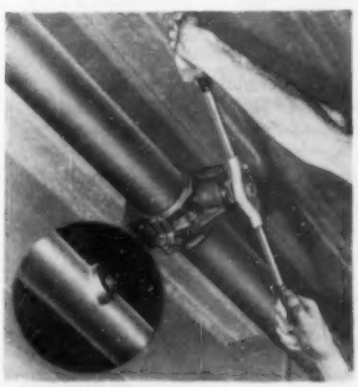


148—Spray Gun applies fine ceramic mist on metal, other nonporous surfaces at high speed and pressure. Coatings can be built up to any thickness. Protects against heat, friction, corrosion. Tip of solid ceramic rod is automatically heated. *Metallizing Co. of America, Inc.*



149—Plastic Conveyor Chains, with flat tops, weigh one-third less than steel, last 2 to 4 times longer than metal conveyors. Don't corrode. Cost less than stainless steel, need little maintenance, no lubrication. And permit speeds of over 200 fpm. *Fenco, Inc.*

150—Solenoid Valve, 4-way a-c, features high fluid capacity, pressures to 3000 psi., low current consumption. Allows cycling rates over 60 cpm. In ⅜-in. pipe sizes, for 110 or 220-v. operation of machine tools, automatic controls, etc. *Waterman Hydraulics Corp.*



151—Tee Turner draws a "tee" from copper tubing in less than 5 min. Tool eliminates need for many reducing tee fittings in copper plumbing. Cuts soldered joints at each branch from three to one. May be used on installed lines without disassembling. *Erie Tool Works.*

Turn the page

MECHANIZE... PROFIT-WISE!

WITH A LAMSON AUTOMATIC AIRTUBE SYSTEM

Station to station service. Carriers have built-in memory.

Orders, invoices, records, punch cards, blueprints, samples, interoffice memos, mail . . .

Everyone complains about mounting paperwork that slows production, increases overhead, cuts profits, ruffles tempers.

Now, you can do something about it . . . put your paper in the air via LAMSON'S AUTOMATIC AIRTUBE SYSTEM. Delivery is assured 24 hours a day in a matter of seconds . . . automatically!

Increased efficiency is so dramatic that the entire cost can be amortized out of annual savings. After that, you enjoy the benefits of LAMSON AIRTUBE almost cost-free for years to come.

This is why you find more LAMSON AIRTUBE SYSTEMS in operation than any other kind.

Write LAMSON for informative catalog today. Or, simply clip this advertisement to your letterhead and mail to:

LAMSON

LAMSON CORPORATION

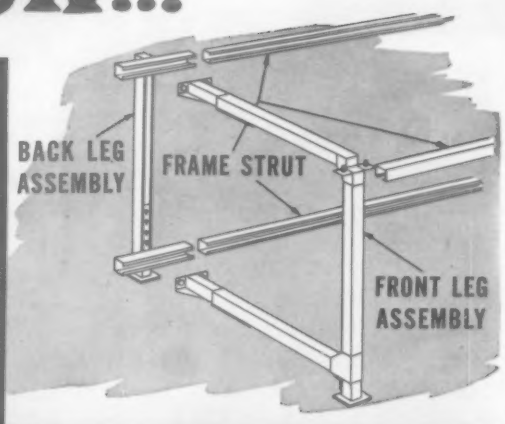
203 Lamson Street, Syracuse 1, N. Y.

PLANTS IN SYRACUSE AND SAN FRANCISCO
OFFICES IN ALL PRINCIPAL CITIES

Circle 446 on Reader Service Card

NOW...

with Standard Parts...



PRODUCT-A-FLOW Modular Work Stations

...become your Custom-Planned Layouts

Free your layout planning from conventional bench limitations. Develop the layout to solve your problems of space, time and motion economy...and set it up with standard Product-A-Flow catalog parts. It's easy! Three types of telescoping members frame any configuration and form many modular accessories. Other modular accessories include shelving, lighting, conveyors, circuitry, piping...and there are drawers, pocketbook holders, etc. All elements positioned where wanted.

Product-A-Flow layouts are readily modified or completely reassembled to meet changing requirements. Exchangeable liftout tops palletize your operation...simply move them with jigs and fixtures attached. You save your investment in benches over and over. Get full details. Send for bulletin 158.

PRODUCT A FLOW

PRODUCTS FOR INDUSTRY

1530 Summer Street • Stamford, Connecticut

REPRESENTATIVES IN PRINCIPAL CITIES

FREE Send for Bulletin 158

FACTORY/EQUIPMENT NEWS

Begins on page 102

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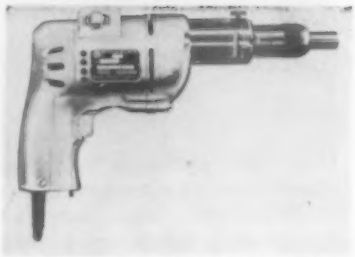

152—Power Screwdriver has Micro clutch that permits depth control to predetermined settings within 1/1000 in. Automatically releases pressure when depth is reached. No damage to screw or work. Scrugun handles machine, wood, self-tapping screws. *Black & Decker Mfg. Co.*

153—Electrical Contactor closes by momentary energization of coil, is held closed by mechanical latch instead of electrical holding circuit. No unwanted openings. Eliminates hold-coil power loss. NEMA sizes to 5; 2, 3, or 4 poles. *Arrow-Hart & Hegeman Electric Co.*

154—Channel Bar, to support electrical equipment, hangs from ceiling to simplify handling of box units, fixtures. Slotted opening, 0.281 in., permits easy positioning of channel carriers, etc., or ¼-in. square nut and threaded rod. *Steel City Electric Co.*

155—Dry Air Pump supplies either pressure or vacuum for processing applications. Produces clean air. No lubrication. Three sizes, capacities from 3.9 to 32.2 cfm., single or double shaft extension, clockwise or counter-clockwise rotation. *Conde Milking Machine Co.*

Turn the page

4 REASONS WHY CBS VR TUBES ARE YOUR BEST CHOICE

1. **A SPECIALIST** — There's a special reason why CBS VR tubes are more stable and dependable. CBS Electronics specializes in VR tubes . . . has made over 20 millions of them.
2. **ADVANCED ENGINEERING** — Within their voltage and current ranges, the reliabilized CBS 6626 and 6627, for example, provide an absolute minimum of discrete voltage shifts in voltage reference circuits.
3. **RESEARCH AND DEVELOPMENT** — CBS Electronics has originated many VR types: OB2, USN-OA2WA, USN-OB2WA, 6830, 6831 as well as the 6626 and 6627.
4. **WIDEST LINE** — Commercial and military, miniature and GT, 105-volt and 150-volt . . . CBS Electronics offers the most complete line of VR tubes for voltage regulation and reference.

Reliable products through Advanced Engineering

These four reasons help to explain why more and more industrial electronic maintenance technicians specify CBS VR tubes. Like the original equipment manufacturers, they have discovered they can have the best in VR tubes simply by asking for CBS. Your Manufacturers Warehousing Distributor has them in stock. Just call him for prompt delivery.

CBS ELECTRONICS, Danvers, Mass.
A Division of Columbia Broadcasting System, Inc.

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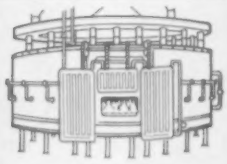
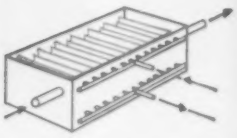
PLATECOIL®

ADAPTS TO YOUR HEAT TRANSFER PROBLEM

a wide variety of designs and sizes





ALL TYPES OF TANK AND PROCESS HEATING AND COOLING

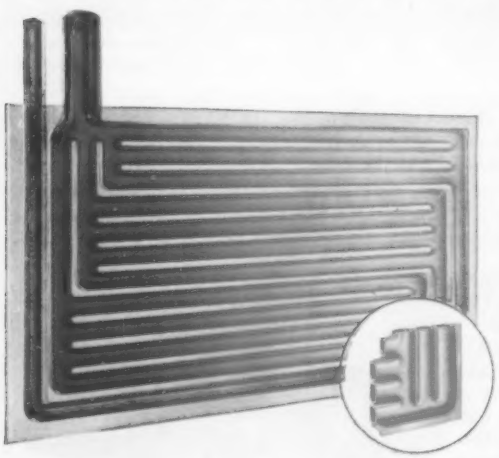
OVEN AND FURNACE USES

EXTERNAL OR INTERNAL MOUNTING

WASTE HEAT RECOVERY

PLATECOIL is the versatile, factory fabricated answer to heat transfer problems of all kinds. You can apply PLATECOIL to all types of tank and process heating and cooling — open tanks, closed tanks, agitated tanks, deep tanks, jacketed tanks, sumps, kilns, ovens and many others. Basic PLATECOIL types include header and serpentine designs in single embossed, double embossed, flat, rolled and banked units. They are available in mild steel, stainless steel, Monel, Ni-o-nel, Hastelloy B, Hastelloy C, nickel, and many other metals. Special designs, surface finishes, structural parts and connections add to their versatility. Operating pressure now rated up to 250 psi.

NEW MULTI-ZONE* PRINCIPLE PRODUCES MORE EFFECTIVE HEAT TRANSFER



Multiple headers with multiple condensate returns provide better steam distribution and more total effective heat transfer area in the new MULTI-ZONE PLATECOIL. FREE-FLO action, without condensate trapping increases processing production through faster "start-up" and extremely fast temperature recovery. This reserve capacity also holds temperature variations to a minimum. PLATECOIL eliminates problems of engineering, fabricating, installing and maintaining pipe coils. PLATECOIL units are lightweight and easy to handle. They are compact and save tank space. Deposits do not build up on streamlined PLATECOIL surfaces as they do on pipe coils. All stainless steel and alloy PLATECOIL units affected by cold working are annealed and pickled after fabrication to return the metal to its original condition and thus eliminate the probability of corrosion due to internal stresses and carbide precipitation. PLATECOIL is also relatively simple and economical to remove, clean and re-install. In most cases there is no need for threaded joints within the solution to corrode or leak.

Investigate the possibilities of PLATECOIL for your specific problem.

**Patented*
Send for Bulletin P60 for more data.

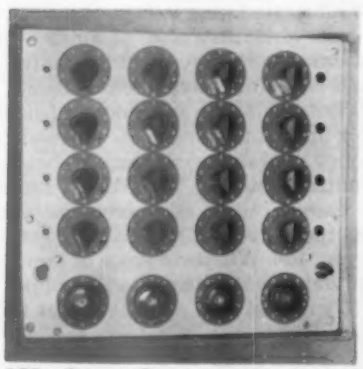
Tranter Manufacturing, Inc.
LANSING 9, MICHIGAN

PLATECOIL® DIVISION

For more about these items, circle item numbers on Reader Service Card next to back cover.

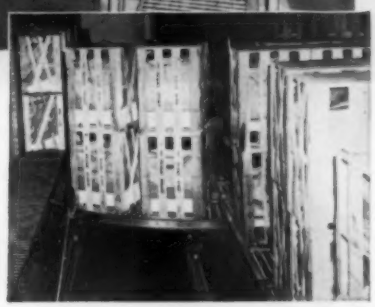
156—"Lightguard" automatically turns lights on at about one ft.-candle, off at 10 ft.-candles. Small (1¾ in. dia.) switch is weatherproof. Built-in time delay prevents false actuation by auto headlights, etc. For loads to 300 watts at 120 v. *Schacht Electronic Mfg. Co.*

157—Wheel Conversion Kit, for walkie and electric trucks, adapts one wheel size to different models of same make truck. Reduces inventories by permitting standardization of wheels and bearings for whole fleets. Kit contains axles, bearings, four polyurethane wheels. *Maco Industries, Inc.*



158—Preset Counter, with 3 to 6 digits, 1 to 6 preset stopping points is completely transistorized. Uses little power, less than 10 watts at 115 v. a-c. Features solid state power supply, plug-in output relay, compact glass fiber cabinet. *Oxford Engineering Co.*

New A-F
"PIGGY BACK"
Conveying System



Helps To Double Output Cut Handling Costs

Speed Queen clothes washers and dryers go to market faster—since this new A-F *Job Engineered* Double-Stack Conveying System was installed in the Ripon, Wis. manufacturing division of McGraw-Edison Co.

Crates come off one of three feeder lines from assembly (photo, left) to the automatic stacking units where every second crate is elevated to ride "piggy back" on the crate that comes beneath it. Stacked crates are routed onto one of nine conveyorized storage lines. Photo, right, shows switch-type device transferring "piggy backed" crates from desired storage line to conveyor for delivery to cars.

Machines are pre-selected, through a railroad switch-type device, for loading in semi-trailers or railroad cars. By switching from one line to another, an operator is able to send the proper number of each machine in the correct shipping order.

What is your parts or products handling problem? We may be able to help you transform problems to profits.

Why not write us—today?

A-F

A-F ENGINEERED CONVEYING SYSTEMS

Also Pre-Engineered Conveyors—
Wheel, Trolley, Roller, Belt
Metal Cleaning and Processing Machines

THE ALVEY-FERGUSON CO. 131 Disney Street Cincinnati, 9, Ohio

For more facts Circle 450 on Reader Service Card

(X) MARKS THE SPOTS
where 4 valves are replaced by 1...

. . . And that one valve is a Rockwell-Nordstrom Multiport lubricated plug valve. Above, it is controlling flow in *four* directions—a multiple job only this type of valve can do.

This could mean big savings in your plant, plus more efficient traffic control of everything you flow through pipe. For instance: A large sugar refinery had trouble efficiently routing slurry to process units. A Rockwell field engineer recommended Multiport valves, since *one* Multiport does the work of *three* or *four* ordinary valves. With fewer valves and simplified piping and fittings, the new installation quickly paid for itself by eliminating costly flow control errors and improving quality. And since Rockwell-Nordstrom is the most *complete* line of lubricated plug valves, the Rockwell field engineer was able to make a number of other valve suggestions for improving flow control, preventing waste, and reducing valve maintenance.

There are literally hundreds of ways Rockwell field engineers are helping manufacturing and processing plants save time, money, and materials through better measurement and control methods. The experience of the world's largest manufacturer of valves, meters, regulators, and other measurement and control products, can pay off for you, too. Wherever gases or liquids flow through pipe in your plant, there is a real opportunity for savings. It will cost you nothing to get the facts. Simply send the coupon.

ROCKWELL

The leading single source for Measurement / Control products and ideas

For more facts Circle 451 on Reader Service Card

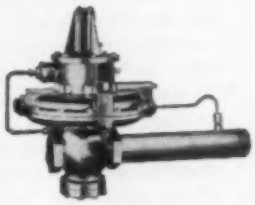
"IN-PLANT" METERING:

LIQUIDS AND GASES

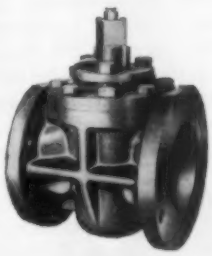
Rockwell gas and liquid meters, properly applied, can improve quality control, sharpen cost control, and prevent waste in almost every plant department. A Rockwell Field Engineer can help you find *where* meters will cut costs . . . and Rockwell has a complete line of meters to measure practically anything that will flow through pipe.

CONTROLLING PIPED MATERIAL:

LIQUIDS AND GASES



More efficient control of all the material flowing through pipes in your plant is a positive step in cutting costs. There are new applications and new ideas for using gas pressure regulators and valves that will stop wasteful, inefficient, and dangerous handling of fuels, production fluids, and products. A Rockwell Field Engineer can show you *where* and *how*.



HOW MUCH COULD YOU SAVE?

There is hardly a plant of any kind—including yours—where the right application of the right measurement and control methods and equipment won't produce savings many times the modest cost involved. It will cost you nothing to have a Rockwell Field Engineer *show* you. Simply send the coupon below, now.

SEND COUPON NOW!

MEASUREMENT & CONTROL DEVICES

another fine product by

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☐ Please have a Rockwell Field Engineer call me for an appointment.

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I am concerned primarily with ☐ Light & Heavy Metal Fabricating ☐ Basic Chemical Production ☐ Chemical Processing ☐ Food, Drugs & Tobacco ☐ General Manufacturing Operations ☐ Petroleum Processing

☐ Others: _____

Name: _____ Title: _____

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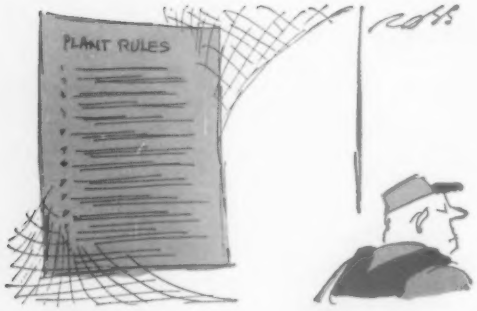
City: _____ Zone: ____ State: _____



Cobwebs on Your Plant Rules?

Posted plant rules gather dust in more ways than one, according to Roger, Slade & Hill, management consultants (New York). A case in point concerns an executive vice-president of a medium-sized plant, who, for years, was indifferent to placards of rules hanging in every department. The employees seemed to share his feelings.

One day, he read and re-read the plant's 8x10-in. manifestoes set in crowded, barely legible type. Many of the rules were "don't's" backed up by threats of firing for violation. Reasons for the restrictions weren't stated. Furthermore, the rules forbade actions that most people with sense didn't do anyway. Another batch were defiantly disobeyed and the V-P included himself among the guilty. Nine-tenths of the remainder were not arbitrary prohibitions, but reasonably stated safety precautions.

These, the V-P salvaged along with the reasonable "don't's." He then re-worked them into readable, dignified, yet persuasive language. Employees liked the revised code. Even the union applauded it.

No Panacea for Labor Turnover

There are no set techniques for reducing labor turnover, according to Dr. F. J. Gaudet of Stevens Institute of Technology, Hoboken, N. J. In a recent report published by the American Management Association, Dr. Gaudet claims that methods said to be successful in one company almost invariably fail in another. Even researchers' findings disagree.

Despite these conclusions, Gaudet names a few techniques that have proved successful in reducing turnover. They include weighted application forms, psychological testing (not originally designed to reduce turnover, but successful for this purpose), on-the-job methods such as better training techniques and communications, and research aimed at finding out why employees leave the company.

Human Relations in 15 Words

Want to improve your human relations in five short lessons? Offered by Henry J. Kaiser Company (Oakland, Calif.), this five-phrase capsule course consists of 15 important words. Here it is in reverse numerical order:

- Five most important words—I am proud of you.
- Four most important words—What is your opinion?
- Three most important words—If you please.
- Two most important words—Thank you.
- Least important word—I.

Workers of the Future—Scoot

Instead of walking to far corners of the plant, tomorrow's worker may hop on a motorized scooter. The "skeeter," designed by Louis Richards, a student at Illinois Institute of Technology, beats the smallest foreign car for fuel economy, using only 3 ounces on a 10-min. run. Workers can carry fuel around in an extra thermos bottle. Aluminum platform and engine (model airplane type) are mounted over roller-skate wheels. To start the engine, rider places one foot on platform, pushes off with the other. Once underway, the handle steadies the rider. He leans in the desired direction to steer.

What U. S. Foremen Earn

Foremen earning $556 a month are sitting right on the peak of the national average. Vision, Inc. (New York), surveyed 1418 companies with 33,373 production foremen, 866,874 employees. Western workers get the highest wages; southern, the lowest. Almost two-thirds of the plants pay between $450-$650 a month; roughly one-eighth pay less than $450; one-fifth pay more than $650. Only one company in a hundred pays $10,000 a year.

"Soup to Nuts—12:30 Please"

If long lines at lunchtime are cause for grumbling and diminishing patronage in your cafeteria, here's a sure cure. At Ansco (Binghamton, N. Y.), an employee, by telephoning any one of the cafeterias in advance, can have a complete lunch waiting for him any time he specifies. He is offered this service at no extra charge. Order may include soup, sandwiches, salads, beverages, and pastries to be picked up at the cafeteria cash register. There's no waiting in line for a "quick" lunch.

An extension of this "take-out" service is the "take-home" order. A day's advance notice is enough to produce any of the above items in quantity for home consumption. For afternoon and evening chow hounds (from 2 to 7:30 p.m.), the cafeteria offers hamburgers, hot dogs, and pancakes prepared by short-order cooks.

So the wife and kiddies can take advantage of the service, Ansco features "Family Night" each Thursday. Regular meals cost 85¢. Children's portions are available for 50¢. When not serving the employees, the company's cafeterias are available for banquets or as catering service.

Taking Town's Labor Pulse

Tax concessions and the like are accepted methods of attracting industry to a town, but no manufacturer would move to an area without assurance of an adequate labor potential.

A Haskell, N.Y., businessmen's committee, attempting to interest a company in setting up shop, is sounding the depth of local labor resources.

This is being done by placing ads in the local paper asking men interested in factory work to mail a resumé to the committee. Women who would like an unskilled position are just asked to mail in their names.

Respondents will be the first ones interviewed for employment, if and when the plant is constructed.

Tomorrow's Egghead Worker

The American worker is slowly becoming an egghead. Such is the belief of Clarence H. Thayer, vice-president of Sun Oil Company, Philadelphia. He bases this opinion on the growing trend among industrial workers to acquire more knowledge. According to Thayer, the working man of tomorrow will have a deeper grounding in economics, a keener ability to separate fact from falsehood and sincerity from soft soap, and a higher resistance to being led around by the nose—by anyone.

Briefing Paves Way for Study

No panic seized employees of Rayco Manufacturing Company (Providence, R. I.) when the stranger appeared with stop watch and study board. Why? A note on the bulletin board had explained it:

"On Monday, June 15, Richard Feeney, a new engineer, will join the engineering department. We have been looking for an additional person for quite some time and believe we have located someone who will be a credit to Rayco.

"Richard Feeney has been working in the area of industrial engineering for a number of years and we look forward to his being able to contribute to improvements through his different background.

"During the first few weeks he will be taking time studies and observing operations in most areas of the plant, particularly sewing. The purpose of these studies is for Richard Feeney to become oriented and learn our operations. These studies are not for checking or setting standards. We hope you will give him your cooperation and help."

Teacher-Wives Up Production

Tell the housewife your company's problems if you want to increase employee productivity, advises Sheldon-Claire Company, Chicago motivation consultants. According to Company President Lew Shallett, work attitudes are not formed entirely on the job, but are brought to work from home. "The desire for security is an essential part of a woman's emotional nature," he claims. "If management can show her that the quality of performance by her husband and his coworkers contributes to that security, then it has taken a basic step in the direction of higher productivity."

To orient the little woman, Shallett suggests a series of communications from company executives to employees' wives. Subjects discussed should range from the cost of groceries to economics. This soft sell should convey the relation between security and increased productivity.

US RUBBER TAPES

The Splice is always right

U. S. GRAY PERFECTION TAPE

Made of the strongest fabric, impregnated in every fiber with pure rubber. This U.S. Rubber method of manufacturing eliminates pinholes. The tape has the strongest adhesion. U. S. Gray Perfection Tape will not dry out. Here is a tape that not only meets specifications, but exceeds them.

United States Rubber produces tape for every insulation and splicing need. "U.S." engineers know exactly what is required of any splicing compound, whatever the application. Simplify your purchasing by ordering from *one* line — the "U.S." line. Get in touch with any of our numerous distributors or one of our strategically located Branch Sales Offices, or write to address below.

USCO SPLICING COMPOUND

High dielectric resistance makes it especially suitable for high voltage work on railroads, power lines and signal lines. Usco is waterproof and always durable.

...and so is the price!

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SPLICING COMPOUND
OZONE AND MOISTURE RESISTING COMPOUND
Uskorona combines maximum resistance to OZONE and MOISTURE with high tensile strength, elongation and dielectric resistance. Fuses quickly without heat or pressure and makes
PERFECT
SPLICES
Made in U.S.A.
UNITED STATES RUBBER CO. PASSAIC, N.J.

USKORONA® SPLICING COMPOUND

This is the ozone- and moisture-resistant tape for overhead splicing where high dielectric protection is needed. Uskorona fuses quickly without heat or pressure and makes the splice an inseparable part of the original insulation. Uskorona is superior in tensile strength, durability and moisture absorption. Use the time-proven Uskorona splicing compound—and be *sure*.

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Mechanical Goods Division

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WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

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DETREX
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Unnoticed Changes in a Metal Cleaning Operation Often Affect Solvent Consumption

We were recently asked by a large user of trichlorethylene for a sure procedure for spending the least number of dollars for this chemical.

The procedure necessary to assure the most economical use of trichlorethylene is neither mysterious nor difficult, but it is precise.

To understand it, it is necessary to accept this fact:

1) When a change occurs in the product, or
2) When a change occurs in manufacturing, or
3) When a change occurs in racking, or
4) When a change occurs in the human element, or
5) When a change occurs in the machine –

a change will also occur in the quantity of trichlorethylene being consumed. It is not unusual for one of these changes to occur every month, and many times it will go unnoticed. The *only* procedure that will get the *best* result is:

1) To ascertain the necessary facts, and
2) Have expert appraisal of those facts.

A program can be set up to cover both. We have been doing it for 27 years. We would be very happy to institute such a program for you.

Depend on DETREX for Every Metal Cleaning and Processing Need

- PERM-A-CLOR NA (Trichlorethylene)
- Solvent Degreasers
- Ultrasonic Equipment
- Industrial Washers
- Phosphate Coating Compounds
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- Aluminum Treating Compounds
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- Rust Proofing Materials
- Extrusion and Drawing Compounds
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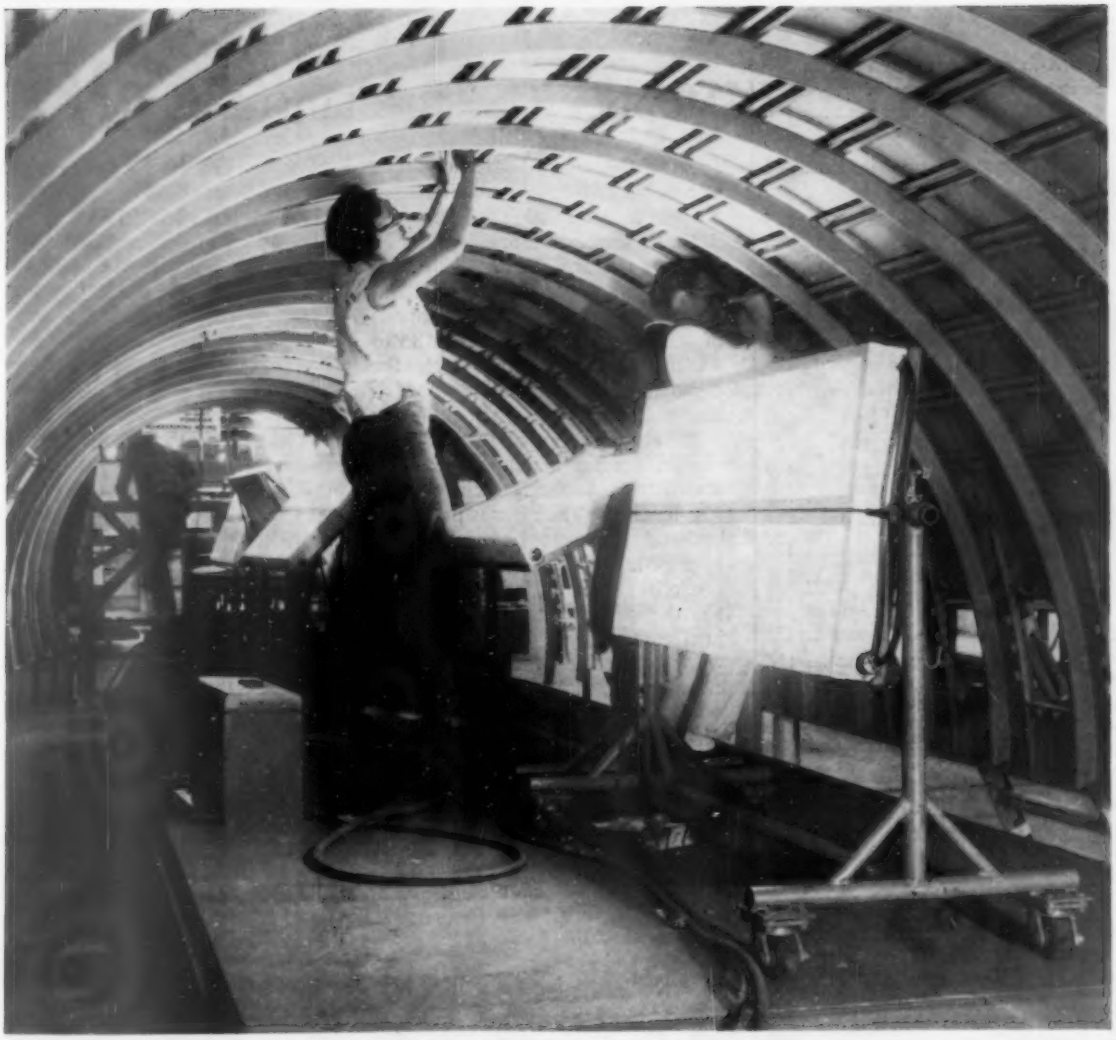
World's Largest Exclusive Producer of Cleaning Chemicals and Equipment

FACTORY

PLANT OPERATIONS

CASE BOOK



LIGHT TO WORK

Portable lighting stands have turned gloom into light at Rohr Aircraft Company. Assemblers used to work with 5 foot-candles. Now they have 110 to 150 . . . page 145.

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HOPPER CAR TO TRAILER . . .

. . . TRAILER TO PLANT

Hopper Car to Plant—All by Air

Springs Cotton Mills is supplying starch directly to seven mills from a single railroad siding at Lancaster, S. C., by means of a pneumatic bulk handling trailer. The Airveyor Bulk Transport (Fuller Company, Catasauqua, Pa.) unloads 25,000 pounds of starch from hopper cars in 35 to 45 minutes. Then transports the cargo to one of the mills, loads it into a storage bin in half an hour.

Result: The company was able to eliminate a bag handling operation. Starch was formerly delivered in 120-lb. sacks. Then it was palletized by hand, transported to warehouses by fork-lift trucks, and stored until needed. The bags had to be manually dumped into day bins, resulting in frequent sack breakage. This wasted starch. And made plant cleanliness a major problem.

Now starch is delivered in hopper cars fitted with special unloading valves to permit coupling to the trailer. A pressure-vessel-type conveyor system is used to load and unload the cars. Rotary air locks (which tend to grind granular materials) are not used. The hopper cars also double as warehouses for storing the starch until needed.

When the trailer makes deliveries at a plant, the bulk starch is funneled to an underslung transport line. This is connected to the plant pipelines by 5-in. hoses. The dust-laden air is recirculated to a filter located in the trailer.

The trailer itself is 33 feet long, with three steel storage tanks. A compartment in the rear houses the controls. Its pneumatic system is capable of delivering starch to storage tanks 200 feet off the ground.

The trailer's crew of two men is the entire labor force needed for this massive material transfer.

Payoff: The price of bulk starch is 22 cents per 100 pounds under the bagged price.

Polka Dot Paint

Cost of repainting your plant giving you a pain in your pocketbook? Hoffmann-LaRoche, Inc., Nutley, N. J., has eliminated much of that expense. How? By using a highly durable spray-on paint, manufactured by Plextone Corporation of America (Newark, N. J.), on several buildings. No repainting has been necessary during the six years since Plextone was applied to the 1-million-sq.-ft. area. The buildings used to need repainting once a year. This represents a saving to the company of about $25,000.

In many cases, the paint was applied in two or more colors in a single spraying. This created a speckled effect. The multicolored paint was used when Hoffmann-La-Roche switched from costly glazed tile wall covering to cinder block.

Here's the payoff on the paint:

- Masks blemishes.
- Doesn't dull after repeated washings with harsh abrasives.
- Can be touched up easily.
- Breaks up monotony of great stretches of single-color walls.
- Is dust-resistant.
- Large spots in paint completely camouflage the cinderblock.
- Minimum peeling on wet surfaces —can be used in washrooms—even shower stalls.

Portable Stands Brighten Work Areas

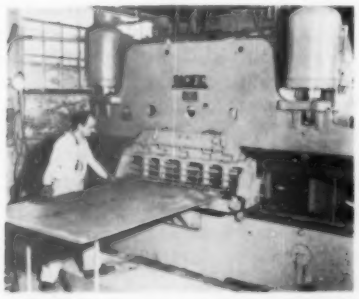
(Cover Story)

Assemblers at Rohr Aircraft Company in San Diego, Calif., used to work with about 5 foot-candles of illumination inside or underneath structures like the lobe sections of the CV 707 jet planes.

Now they work in 110 to 150 foot-candle lighting. Reason: portable lighting stands devised by Rohr plant engineers. The double unit dolly-mounted type in the cover photo (page 143) does the trick.

Two 4-ft. fixtures, each containing two lamps, are mounted on the welded dollies. A trunnion allows the fixtures to be swiveled through at 360 degrees and locked. An expanded metal screen protects the fixture. Over-all height of each fixture is 29 inches, and its base is narrow enough to be maneuvered into cramped, congested areas.

Where adjustable lighting isn't needed Rohr uses the fixtures themselves in rows mounted on conventional supports near the work. Cost of the dollies was $88 each. They're paying off in better work and improved morale in confined areas.



Shearing Device Is Money Saver

A $3500 shearing attachment to this hydraulic press brake saved All-American Engineering Company, Wilmington, Del., some $17,000. That's the difference between the price of the attachment and the cost of a shearing machine.

The attachment, manufactured by Pacific Industrial Manufacturing Company (Oakland, Calif.), can be installed or removed in about 15 minutes. No sharpening of the knife has been required during its first six months in operation. In that time the attachment has been in use 18 to 20 hours a day cutting ⅛-in. steel and up to ½-in. carbon and checker plates.

Paper Negatives Are Trouble Shooters

Alignment and damage problems have been reduced at Librascope, Inc., Glendale, Calif., by the use of paper negatives to make printed patterns on glass epoxy laminated boards. The process also insures dimensional accuracy.

Ordinary photographic film negatives for producing etched circuit boards are sometimes affected by temperature and humidity. The film stretches or shrinks beyond specifications. In addition, photographic film must be handled carefully to prevent scratches and abrasion.

Now, the reversed image of the circuit is transferred onto a thin, translucent paper stock. The negative with its plastic backing is dimensionally stable. And paper is far less susceptible to scars by rough handling. This eliminates extensive touch-up repairs of the printed image.

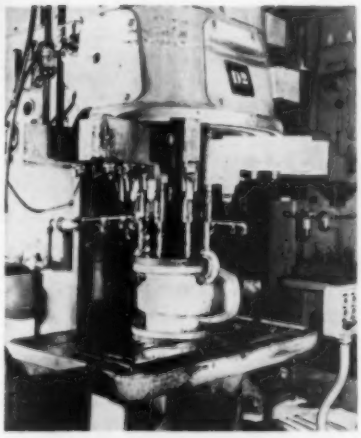
Use of plastic backing material also permits automatic alignment. Circuit boards are jig-drilled with alignment holes at the corners prior to being sent to the printing lab. Pins inserted in corners of the plastic negative support correspond with holes in the board. And hold the board firmly in alignment during the photographic process.

Librascope, a subsidiary of General Precision Equipment Corporation, uses the printed circuits in computers and data processors.

3-D X-Rays Catch Faulty Parts

With 3-D study of x-ray films, engineers at Convair (San Diego) are catching faulty parts in space age missiles. Here's how:

Two films are taken at slightly different angles using standard x-ray equipment. The films are then studied in two modified viewers, in which two mirrors are set at 45-deg. angles forming a V. The observer places his head against the point of the V so each eye looks into a different mirror. The offsetting image gives the observer depth perception.

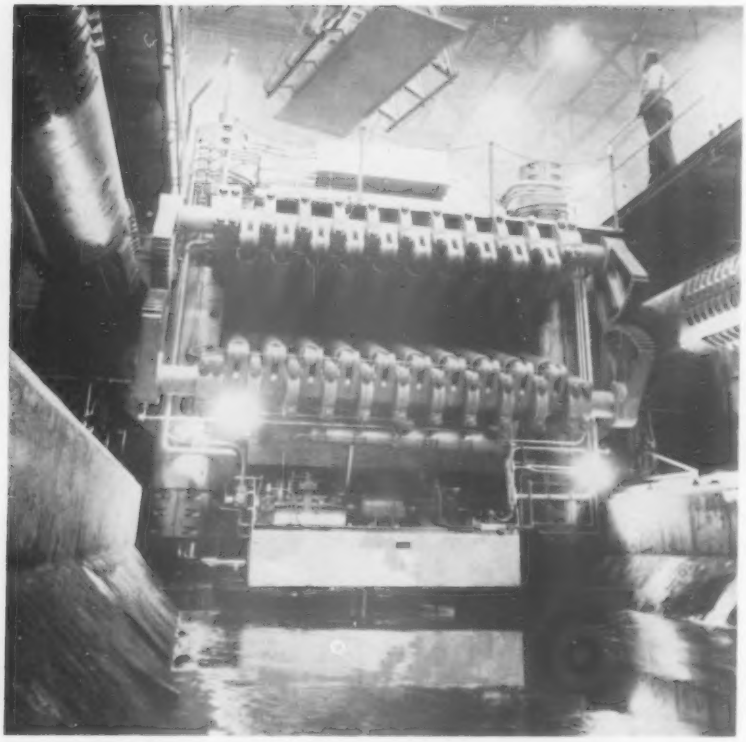


Drilling Simplified

Much of metalworking is still done to garden variety tolerance rather than to super-precision requirements. Alloy Steel Products Company, Linden, N. J., found that simple tooling—when wide tolerances permit—brings best results.

A simple bushing plate, C-clamped to the workpiece, is the only fixture required for drilling the hole pattern in the flanges of steel valves. Location of drills, alignment of working surface, and gripping of part are taken care of by the Natco C3B machine.

This multiple-spindle drilling machine holds the workpiece steady by constant hydraulic pressure exerted on the drills. Steady pressure keeps the drills cutting, prevents work-hardening in corrosion-resistant alloy castings. Also prevents drill breakage by easing drills through the breakthrough point.



STRETCHES WITH A 30-MILLION-LB. FORCE

This mammoth machine can grip the ends of a 60-ft. plate of thick aluminum and stretch its length as much as 4 feet. Used at Kaiser Aluminum & Chemical Corporation's Ravenswood, W. Va., plant, its pulling force is 30-million pounds. This is twice that of the largest stretcher now in the metals industry. Made by Hydraulic GmbH (Duisburg, Germany), the giant machine is supported without a guiding frame. Needs no effort to hold it in a rigidly fixed alignment. It includes a hydro-pneumatic system used like recoil equipment on a heavy cannon. This would absorb the forces unleashed, should a plate break while being stretched at full power.

Epoxy Dies With Longevity

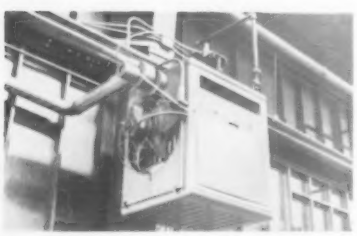
Epoxy dies are generally considered only for short runs. But, Checker Motor Corporation, Kalamazoo, Mich., has drawn as many as 18,000 parts with a single epoxy resin-based die. And the company believes there is no theoretical limit to the number of draws possible with one epoxy die. Downtime for overhauls must be allowed, however.

Checker has drawn 10 major body panels on epoxy dies. For example, epoxy resin, compounded by Ren Plastics, Inc. (Lansing, Mich.), is used to draw wheel housings, hood hinge reinforcements, and floor pans. Some dies are constructed entirely of an epoxy resin mixture. However, the floor pan dies are epoxy-faced and the wheel housing die is backed with boiler plate.

Advantages of epoxy dies: cost savings in labor, easier draws. An epoxy resin die can go from engineering to actual production in one-third less time than its steel counterpart. Spotting time also is reduced. When areas are found that need attention, epoxy can easily be removed or added to form the desired shape. Flexibility of epoxy also simplifies repairs on edges.

The company found that it is 40% easier to make draws with epoxy than with steel dies, mainly because of load distribution. Less spot strain occurs.

The one definite disadvantage to epoxy dies: The resin strength is less than metallic. The user must set downtime aside for repairs.



Gas Units Work Fine and Save Space

Two benefits were gained by Reznor Manufacturing Company when it switched over to gas-fired unit heaters at its Mercer, Pa., plant. (The building had been heated with a centralized boiler and low-pressure steam system.) The benefits:

- Increased space. Space was gained that had previously been taken up by the boiler. And Reznor was able to enlarge its loading dock.
- A flexible heating system. It responds to different demands in various parts of the plant.

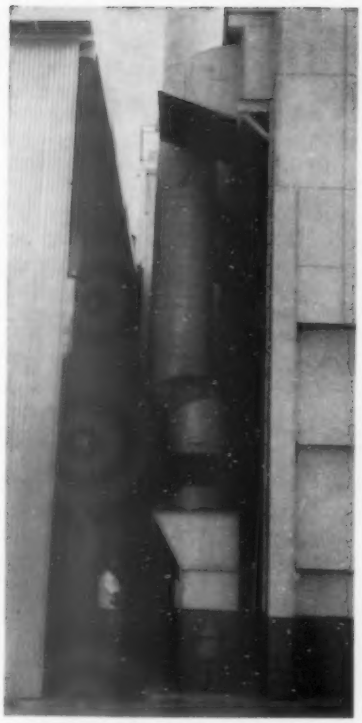
Here's how the system works: All unit heaters are on programed clocks. Heat is turned on and off at specific times. And heat response is so fast there is no discomfort for any employee. Fuel bills are kept at a minimum by bringing gas into the plant at 5 psi. Branches off the main pipelines are run off at a stepped-down pressure.

Under the steam and boiler system it had been necessary to shut down all or a major portion of the heating plant in order to make repairs. Now, individual unit heaters can be fixed quickly.

Polyethylene Bags Keep Metal Clean

Polyethylene bags encasing aluminum are keeping the metal dirt- and moisture-free at Kaiser Aluminum & Chemical Corporation, Oakland, Calif. The bags are placed over pig and ingot bundles and then secured with 1¼-in. steel straps.

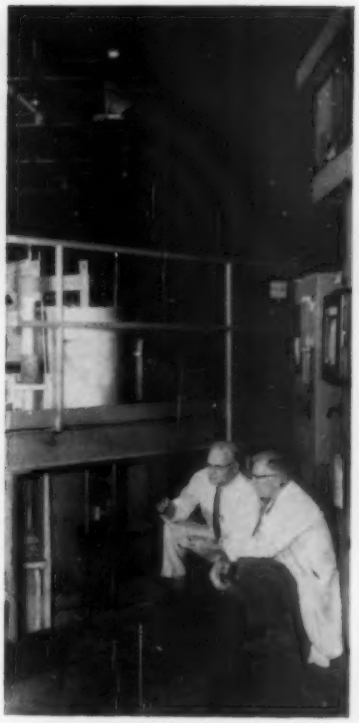
The package is designed to allow air to circulate. This prevents condensation from forming inside the wrap during shipment or in storage. The package can be stored outdoors, eliminating the need for expensive inside storage space.



1. WATER SPRAY CLEANS STACK

2. CATALOG UNITS HOLD DATA

3. TREADLE SPEEDS WELDING



4. STREAMLINING AIDS SAMPLING

Small Expenditures Mean Big Savings

Efficiency need not have a high price tag. That's what Ryan Aeronautical Company, San Diego, discovered. Nominal expenditures have been paying huge dividends in cost cutting, time savings, and product improvement. Here are four examples of dollar savings at penny cost.

1. A pipe ring inside this stack simplified cleaning operations. Formerly, special scaffolding was placed on the roof so mechanics could wash down the interior with a hose. This was done every three months.

Now a water line is run to the top of the stack and connected to a pipe ring inside. The ring has a series of holes that furnish a spray to the entire inside circumference. The stack is cleaned just by opening a valve at floor level. It's done monthly (on weekends) by a standby mechanic.

Cost: $62 to install the ring and $5.50 a year for operation. Net savings: $457 a year.

2. Sectional catalog units with locking bar now prevent removal of material. This has solved a problem of technical data dissemination for Ryan. Formerly, material was handed out to group leaders. Sometimes it filtered down to subordinates, other times not. Material was always getting lost. And supervisors found it hard to keep these documents up to date.

With the new sectional units, the catalogs can be strategically located throughout the engineering area. One employee is responsible for revising and adding to them.

Cost: $42 a unit.

3. An ingenious treadle and linkage set-up—salvaged from an obsolete scrapped tool—has speeded up welding operations considerably. Before, the operator used to assemble the parts to be welded in a holding fixture. Then placed them on a steel welding table. Only one-fifth of the parts were accessible to the welder at any one time.

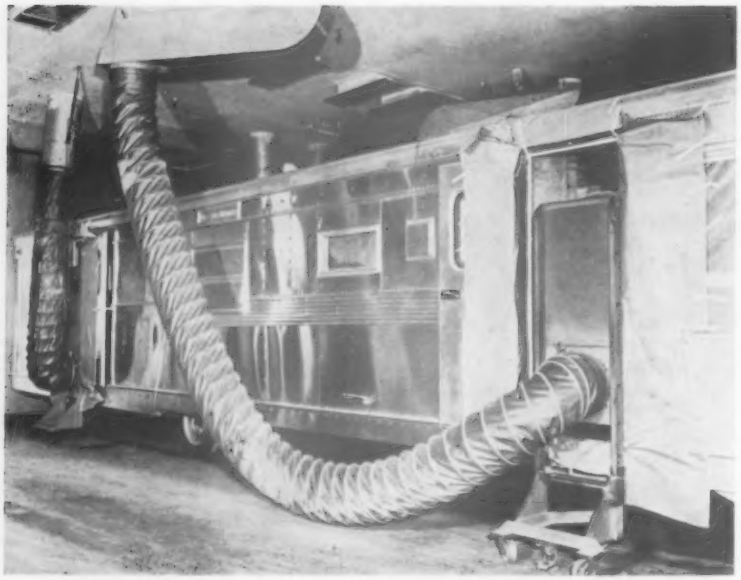
Now the welder rotates the assembled parts with the treadle, which gives him a continuous accessible welding area.

Cost: $14.10 for labor and material. Savings: $1240 in direct labor costs over a contract period.

4. Samples of endothermic furnace gas, for control purposes, were supplied by a constant-speed electric-driven vacuum pump. Trouble was, maintenance costs for the motor and pump were excessive. And manhours required to keep the gas sampling system in operation were too high. Also, when the furnace door was opened to load or unload, the pump continued to emit atmosphere-contaminated gas, which clogged the instruments with carbon.

Ryan engineers discovered that when the furnace door was closed, radiant heat pressure charged the gas sample system automatically. There was no need for the pump. When the door was opened the pressure disappeared, the system was free of contaminated gas. Result: The pump, flow meter, and filter were eliminated. And the dew-cel was moved closer to the furnace.

Cost of alterations: $40 per furnace. Savings: $1010 in maintenance and power costs annually.



FLEXIBLE DUCTWORK DRIES PAINT FAST

No, this is not a giant reptile. It's flexible ductwork. And it's the answer to drying paint quickly at different production points at Spartan Aircraft, Tulsa. The insides of trailers such as the above are painted after assembly, then dried by hot air pumped into the interior through a portable connector at the door. Since the size of the trailer varies and the door openings are not always at the same spot in the drying room, rigid ductwork proved inefficient. The problem was solved when Spartan installed this duct, made of spring wire and neoprene-coated fabric. It's manufactured by Flexible Tubing Corporation (Guilford, Conn.)

Hoppers Dump Waste Automatically

Self-dumping hoppers make short work of waste disposal at New Haven Board & Carton Company, New Haven, Conn. The hoppers, made by Roura Iron Works, Inc. (Detroit), are mounted on skids for transport by fork trucks. The hoppers are emptied at dump trucks, which eliminates the need for a central plant waste collection point.

System works this way: Eight hoppers are placed at various areas around the plant for waste disposal. Pick-up schedules vary with the amount of waste, but each hopper is emptied at least once a day.

Emptying the hoppers is done by having the fork-truck operator raise the hopper above the dump truck. Then he releases a lock handle on the rear of the hopper. It tilts forward to discharge contents and returns to an upright position, locking automatically.

Reprints of the Plant Operating Case Book are available. Price 50¢. For quantity prices write Reader Service Department, FACTORY, 330 W. 42nd St., New York 36.

Screen Stops Drafts in Plant Elevators

Are drafts a health problem in your lift-gate-type freight and passenger elevators? Allis-Chalmers Manufacturing Company (Milwaukee) solved it with a gate covering that's reasonably transparent, light, durable, and easy to install.

The company uses 100-mesh rustproof metal screen tacked to the lift gate. It's fine enough to stop drafts but doesn't interfere with ventilation. It doesn't show scratches like plastic, doesn't upset the weight balance, and can be installed in a few minutes.

Nationwide Phone Links 40 Plants

A new interplant communications system—the first of its kind—links Chrysler Corporation's 40 manufacturing plants throughout the U.S. With it, an official at Chrysler's Highland Park, Mich., plant can dial directly to any of the company's plants in, say, Los Angeles or Atlanta. About 50,000 calls a day are handled by the network.

Calls from any one of the company's 29 southeastern Michigan plants to another in the area require dialing only a 3-digit code and a 4-digit extension number.

The system will also be widely used for transmission of data from business machines at one location to those in another. The equipment translates the electrical impulses of business machines into tones that can be sent over phone lines just as voices are. For instance, the Newark (Del.) plant can send hourly payroll information to the general offices at Highland Park. And have it processed within minutes by computing equipment there.

Other jobs, such as scheduling auto production or maintaining inventory records at plants without data processing equipment, will be easy to handle with this readily available communication link.

Foam Dunnage Cuts In-Transit Damage

If an inefficient material-handling system is skyrocketing costs at your plant, you are not alone. Boeing Airplane Company, Seattle, had the same problem with in-transit damage

to expensive sink and counter assemblies. But it found a solution: Use of re-usable containers with foam dunnage.

Formerly Boeing received assemblies packed in one-way containers with wood blocks to secure the parts. These were inefficient. Sometimes the parts struck the sides of the container, causing damage. Other times the blocking was too rigid, resulting in fractured honeycomb panels and marred vinyl surfaces. After inspection most parts were returned to the original container for shipment to rework areas or back to the vendor for major overhaul. This additional handling aggravated the damage problem.

Now, parts are seated in a styrofoam slotted base inside the container. When the lid is installed, urethane foam blocks press around the top surface of the unit, holding it in place during shipment. Thus the part is prevented from hitting the container at any time.

In addition, the new container uses a locking spindle principle instead of nails to hold tops, sides, and ends. This prolongs its life. Here are some other advantages of the new container:

- Provides for fork lifting.
- One standard-size container serves as a storage unit—can be stacked until needed.
- Costs no more than the old-type container.
- Supports the assembly in a vertical position at all times—in or out of container.
- Opens and closes easily.

Workers Earn Own Christmas Bonus

Looking for a Christmas bonus system that will pay dividends to you as well as your employees? Lincoln Electric Company, Cleveland, uses the incentive system and reports excellent results.

Each employee receives a yearly check representing his or her extra contribution to the firm. Amount is determined by individual merit rating of job performance during the preceding 12 months.

The system keeps the employees on their toes—they realize the Christmas bonus is a matter of their own productivity.

Clip-on Radio Brings Aid Fast

Anywhere within two miles is talking distance for key maintenance employees at Chrysler Corporation's Mound Road (Mich.) Engine plant. Workers can be contacted immediately by means of a compact portable microwave radio device clipped to their shirt pockets.

It works like this: An operator at the central control office pages the worker via a microwave sending unit. This causes a buzzing sound to be emitted by the radio. If the man happens to be in an area where engine and machinery noise is severe, a bright light atop the device will still attract his attention.

The device is primarily used by men who roam the plant in the course of their work. It has proved its worth in emergencies such as breakdowns of huge presses and electrical panels, where any delay in maintenance is likely to prove costly in production downtime.

The signaling system has proved so successful for maintenance that it is being extended to include supervisory personnel at the plant.

Contributions from readers reporting experiences will be welcomed. No need for fancy writing; just a clear, concise statement of facts. If you have photos or drawings, be sure to include. We'll edit for the Case Book. Contributions accepted will be paid for at time of publication. Address: Case Book Editor, FACTORY, 330 West 42nd St., New York 36.

Aluminum Flashing Battles Weather

A new type of aluminum flashing is proving an effective weapon against Mother Nature on the rampage. Applied over spandrel beams, window heads, and other points of the Daily News Building, New York, the flashing provides protection against the elements.

The flashing consists of a sheet of soft-drawn aluminum, coated on both sides with an asphalt compound. The asphalt provides a shield between the aluminum surfaces against which it is placed. The compound, made by Mitchell Rand Manufacturing Company, becomes semi-hard and seals itself against pinholes in any temperature.

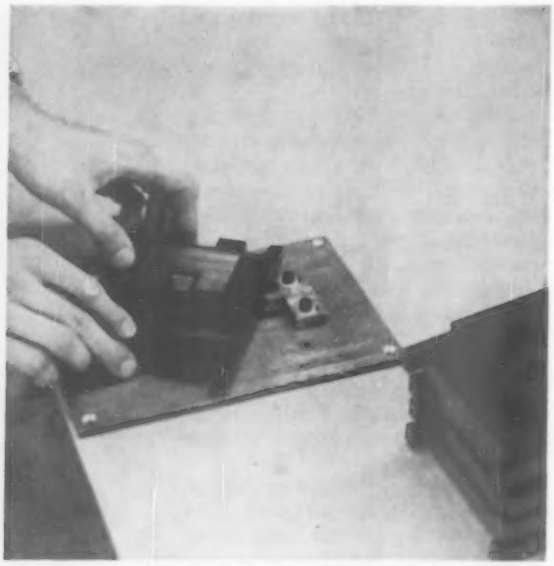
One problem arose when polysulfide rubber calking compound would not adhere to the asphalt coating. This made it necessary to have a clean strip of aluminum wherever the calking was to be applied. Solution: A pressure-sensitive tape is applied to these spots during the coating period. When the tape is removed a clean strip of aluminum is left for calking.

Brazes 26 Tiny Parts at Close Tolerance

This small impeller assembly consists of 16 vanes, 8 studs, and 2 rings. Yet all 26 parts are simultaneously furnace-brazed in a controlled atmosphere, with ring flatness held within 0.01-in. total dimensional tolerance.

Here's how it's done at Wall Colmonoy Corporation's Montebello, Calif., plant: Parts are first tack-welded for initial positioning. Then Standard Nicrobraz brazing alloy is applied. Brazing is done in a pure dry hydrogen furnace at 2150 F.

1. SWITCH AUTOMATICALLY OUSTS WELDS.



2. GRINDER BOOSTS PRODUCTION 300%.

3. DUAL FIXTURE DOUBLES TAPPING OUTPUT.

4. BUFFS 12 PARTS AT A TIME.

Two-Phase Methods Improvement System Increases Production, Boosts Quality

A two-phase methods improvement program at Square D Company's Molded Case Circuit Division plant in Cedar Rapids, Iowa, is reaping triple benefits. First, increased production capacity. Second, improved quality of product. And third, substantial direct cost savings.

The program's first phase occurs during the designing of proposed tools and equipment. An industrial engineer reviews preliminary proposals with the tool designing group. Then periodically examines layouts at various stages of development.

All employees take part in the second phase. Each department establishes an annual goal for savings. These goals are reviewed by top management. All resulting ideas go to the industrial engineering department for review and possible installation. During the 12-month period, a monthly report is issued indicating the current status of each department in meeting its goals.

Here are four ideas adopted from Square D's program:

1. Switch separates good parts from bad. A small switch added to

each of the stamping dies turning out bimetallic parts permits the use of coil rather than strip stock. This makes the operation automatic. Before, stock had to be hand-fed to the punch press.

It works this way: The raw stock vendor supplies the stock notched at the welded joint. When the switch senses the notched area, the direction of the air ejection chute changes. Thus parts containing welds go into a reject pan, while good parts go into an accept pan.

2. Hand grinder removes flash, ups production. A high-speed hand grinder has replaced the old time-consuming hand-filing method of removing flash—in a flash—from bakelite parts. As a result, production has zoomed 300%. Here's how: A guide is mounted to the top of the work bench. The bakelite piece rides against the guide permitting the grinder to remove only the flash.

3. Dual fixture taps two parts at a time. A multi-spindle lead screw tapper is coupled with a dual holding fixture. This means two small parts can be tapped simultaneously and inexpensively. Formerly, parts were tapped one at a time on a single-spindle drillpress. But, in cases where high volume was involved, the company was forced to use the costly dial feed and mechanism to tap two parts at the same time. This meant an expenditure of $300 to $400 per part.

Now the operator places two parts in the dual fixture simultaneously. The set-up automatically ejects parts after tapping, clearing the way for the next pair. Because of the low cost of these fixtures—estimated at $20—even small runs can be tapped two at a time.

4. Buffs 12 parts at a time in strip form. Latches for overload relays are now fitted with contacts and buffed while they're still in strips of 12. Formerly these operations had to be performed on each part separately. With the new system vendors are required to furnish the parts in strip form specially scored and lanced so they can easily be separated by hand.

Under the old method each part had to be individually positioned on the wheel for buffing. Now the operator just has to fasten the strip onto a fixture. All 12 parts on the strip are then buffed in one pass at the wheel.

PUNCHED CARDS ON QUALITY . . . PRODUCE TIMELY REPORTS.

Punched Cards Feed Back Quality Control Data in a Flash

Quality control information feeds right back to the production worker at Emerson Electric Manufacturing Company (St. Louis). And the feedback is fast. Reason: An IBM punched card system shows up major recurring defects, pinpoints operators responsible.

This new evaluation method for quality data, used at Emerson's Avionics Division, has reduced repetitive rejections of electronic parts to 18 per week. This is 300% less than the number claimed six months ago when the program started. In addition, the percentage of total rejections has been halved.

The evaluation system starts where most quality control systems start—right at the point of production. Each operator has a stamp assigned him with his personal identification number. He uses this to mark a data sheet accompanying parts as each operation is completed. The data sheet accompanies parts along the production line until they reach the inspection table. Here the inspector makes out a daily report with the quality data for each part, including his evaluation and defect information where applicable. These defect data appear as a coded number for processing by punched cards.

At this point, a quality control analytical group takes over. It reviews daily inspection reports to make certain no data are missing. Once approved, reports go to the key punch section (left photo). The resulting punched cards, giving a complete history of the part including defects, are collated in two ways. The first sorting by defect code reveals the recurring frequency of each defect. This information is used by quality control personnel in making a trouble analysis. Second collation according to worker number shows which operators are responsible for defects.

These reports (right photo) help the supervisors evaluate operators' qualifications, and determine if any special training is necessary to assure an acceptable product. Every six months a cumulative report is prepared giving a complete history of each operator's performance.

YOU BE THE ARBITRATOR

THE CASE OF

The Unqualified Foreman

Out of the experience of the American Arbitration Association

When business picked up in a textile mill, management decided they could use another foreman. Ralph L., one of the lead men, was their pick. They offered him the spot and explained that although as a foreman he would be outside the bargaining unit, the seniority he had accumulated wouldn't be lost. Under the union contract, he could bump his way back into his old job if things got slow again.

Ralph agreed and the promotion went through. As things turned out, however, it was a mistake from management's point of view. He was "too easy" on the men and didn't get things done on time. The personnel manager considered transferring him back to his old job, but decided that would be bad for morale. And so, regretfully, the company fired him.

The union filed a grievance. The company first argued that what management did with respect to a foreman didn't concern the union at all. "In any case," the personnel manager said, "Ralph's seniority protects him only in case of layoff for lack of work. It doesn't prevent the company's discharging him for incompetence."

Eventually the case went to arbitration. Suppose you were the arbitrator. How would you rule?

For the actual decision turn to page 158

How Movies Can Work for Business

Audio-visual methods for teaching and documentation are gaining increasing acceptance as important tools for business and industry. Eastman Kodak Company (Rochester, N. Y.) and Universal Film Products, Ltd. (San Antonio, Tex.), suggest you try these 14 ways of making movies work for you:

1. Illustrating new merchandise to your various agents, distributors, and dealers.
2. Providing accident reports to insurance companies involving cars, trucks, and the like.
3. Providing burglary and vandalism reports to insurance companies and other interested agencies.
4. Filming conventions both for historical and review purposes.
5. Instructing salesmen.
6. Evaluating potential new products—sending out film to sales agents for opinions before going into production.
7. Improving employee relations, office procedures, good will.
8. Helping fire prevention and control. Since each plant has certain individual problems, a special filmed program applicable to the specific installation can be made.
9. Giving advertising suggestions to agents and distributors.
10. Institutional advertising.
11. Product and material handling, packaging services.
12. Security film reports.
13. Time and motion study.
14. Training of personnel.

Plastic Coating Protects Tanks

A plastic coating system is protecting steel fuel tanks against rugged weather at Scattergood Steam Plant, Los Angeles. Can do the same for exterior tanks at your plant.

The company found their 8-million-gal. steel tanks began to rust even before fully assembled. A combination of rain, sun, smog, and salt-laden mist was the culprit.

The cure lay in a four-coat (Union Carbide) vinyl protective system developed by Surface Engineering Company (Wichita, Kan.).

Here's how it was applied: The tanks were first sand-blasted to remove accumulated rust. Then a pigmented primer was sprayed on immediately to prevent new rust deposits. This was followed by two coats of Hi-Build vinyl coating. A final coat, consisting of a third vinyl formula, gave the tanks a gloss finish from which rain will wash away dirt and dust. Specially blended colors of light tan and medium brown were used to match the color scheme of the plant.

The system has a life expectancy of 8 to 10 years. It will not oxidize, and is resistant to moisture, industrial fumes, oil, salt water, and other corrosive elements.

Aptitude Tests Tell Worker Potential

Two personnel administrators were discussing the pro's and con's for recently interviewed job applicants at Babcock Radio Engineering Company (Los Angeles).

"Quality control engineer's tests show Joe Smith has definitely got the makings of a good production supervisor," one commented.

"Dick Clark has a solid engineering background, but he wouldn't

amount to a hill of beans as an administrator," said the other.

Are these men clairvoyant? No, but a battery of psychological tests —costing $25 a set—have given them insight into the new employees' potential. And by knowing these abilities, the company is laying the foundation for its expansion. Growing pains will be minimized. There'll be little fumbling to place a man in a newly created job, few or no readjustments involving reduction in position, pay, or prestige. Tests provide a blueprint to place the "right man in the right job."

Personnel already with the company are also taking the tests. They answer these questions:

1. What technicians show promise to advance into supervisory or managerial positions?
2. How capable of advancement and along what lines would the present supervisors and managers go?
3. How much difference was shown between the test's objective evaluation and the personal evaluation already given to employees?
4. Is the company in danger of losing some bright, young talent who might feel pigeonholed due to lack of immediate, spectacular progress?
5. What partially trained young men who show promise should be encouraged to get more training?

Adjustable Shelves Solve Storage Woes

Some 76,000 square feet of steel shelving at Ford Motor Company's Sharonville, Ohio, plant can be fitted in seconds to meet up-to-the-minute supply requirements. Since the company changes 40% or more of its stocks at this plant yearly, this arrangement solves a storage problem of major proportions.

A numerical-sequence code system is used in conjunction with the shelves. The code streamlines the dozens of daily shelving readjustments needed to accommodate incoming tools and supplies. All supplies are stored in numerical order regardless of fluctuations in volume or variety. The system has eliminated the need to keep 15% of the shelves empty for emergencies.

The shelves, manufactured by Standard Pressed Steel Company (Jenkintown, Pa.), can be adjusted by unlocking the pivoted thumb-locking devices at each corner of the shelf. Shelf and supporting brackets are then repositioned and relocked in place. Shelves can be removed fully loaded if necessary.

Ski-Lift Ride to Change Bulbs

This ski-lift carriage may look more at home at Lake Placid than in a plant. But it's solving the problem of changing bulbs on high ceilings for Texas Eastern Transmission Company (Baytown, Tex.)

The carriage, equipped with a safety bar, is attached to an overhead traveling hoist. When servicing fixtures in high ceilings, such as those in a warehouse, the sitting employee moves horizontally from one area to another.

Cost: Just $75, including materials and employee's time to build the carriage.

CASE BOOK CAPSULES

Heat exchanger weighing 60 tons will make steam out of heat generated by nuclear fission at Consolidated Edison Co.'s atomic electric generating station at Indian Point, N. Y. The exchanger (Babcock & Wilson Co., Barberton, Ohio) measures 40x13 feet.

Sound tracer signals from inside gas pipes have pinpointed leaks in underground piping during tests conducted by the Institute of Gas Technology, Chicago.

Gigantic machine that will be able to form space age components up to 10 feet in diameter and 24 feet long has been announced by Siegler Corp. (El Segundo, Calif.). The Spin Forge, when completed, will weigh nearly 300 tons.

Use of a two-way radio for fork trucks was demonstrated recently by Motorola, Inc. (Chicago). Payoff: Dispatcher has control over trucks at all times.

Instrumentation systems, pneumatically operated, will automatically monitor and control operations at six water treatment plants. They're being manufactured by Minneapolis-Honeywell Regulator Co. (Minneapolis).

Pressurized containers for the three-story-tall Polaris missile are being made by Lockheed Aircraft Corp. (Burbank, Calif.). Lockheed says these containers could carry a shipment of eggs over a corduroy road without a shell broken.

A surface condenser is being erected on the Mississippi River by Louisiana Power and Light Co. in one-third the time previously needed. Reason: Prior to shipment, machine was fully fabricated and aligned into shell components by American Standard Div. (Buffalo).

New synthetic rubbers and plastics with exceptional resistance to heat, light, and radiation are predicted in near future by Dr. J. D. D'Ianni, vice-president of Goodyear Tire & Rubber Co. (Akron).

DESCALES TWO STEEL STRIPS FAST

This Rotoblast machine for descaling stainless steel coils keeps costs under control at Universal-Cyclops Steel Company's Coshocton, Ohio, plant. The shot blast machine, manufactured by Pangborn Corporation (Hagerstown, Md.), handles two strands of steel simultaneously, requires only one operator. It descales at speeds up to 80 linear fpm., needs only four blast wheels for the operation. To position the wheels, operator just pushes a button. Rotoblast steel shot is the abrasive used. Effective abrasive cleaning and recycling equipment is built integrally into the machine. This means abrasive can be used over and over again.

Roof Structure Halts Waste Fallout

Is fallout of industrial waste turning areas around your plant into eyesores? International Business Machines Corporation put an end to the situation at its Burlington, Vt., plant by means of a roof structure. Might also work for you.

Carryover of chromic acid mist and condensate coming through the exhaust stack dropped out. This formed unsightly and harmful deposits in an area extending 50 yards from the stack. Noses rebelled, too.

Here's the cure IBM used: The 3-ft.-square stack, with its standard weathercap was lowered to within 36 inches of the roof. Then an 11x8-ft. plywood structure was built around the stack. The roof within this area was curbed and given added pitch protection. A drain was installed and piped directly to the waste disposal trench below.

The results are twofold. First, the structure acts as a plenum—the fumes lose velocity, the entrained mist and condensate drop out inside the building, the acid is washed into the drainage provided. Second, the short stack is well protected from damage by high winds.

Hopper With Faucet Salvages Oil

Use of self-dumping hoppers with faucet attachments has resulted in a 60% increase in the amount of reclaimed cutting oil at American Rivet Company, Chicago.

Previously oil drums were placed at various points in the machining area to collect turnings and waste products. Oil salvage was difficult at best since, to allow drainage, each drum had to be upended with the scrap held back.

Now three or four hoppers (made by Roura Iron Works, Detroit) are placed at a central location. Turnings and scrap are collected in small tote pans and emptied into the hoppers. The oil is allowed to drain by means of the elbow-type faucet at the bottom of the hopper.

Toggle Clamp Saves Set-Up Time

The squeeze is the same, but the grip is a fast-setting clamp instead of the old bolt-down arrangement. It's the new way Rohr Aircraft Corporation's plant at Chula Vista,

Calif., secures milling fixtures to work tables for machining.

Heavy-duty toggle clamps (General Alliance Corporation, San Diego) apply as much pressure with the turn of an adjusting screw as the old bolt, nut, spacer, and strap combination. They're six times faster to set up than the bolt-down system, permit more flexible positioning of fixtures on the table. Clamps can be tightened to the swivel and slid along the table's T-slots without excessive play. Nuts are tack-welded to hold the adjustment. This enables operators to use them repeatedly without further loosening or tightening of the T-bolt.

Coated Steel Coil Saves on Paint

Coiled steel, pre-coated on one or both sides, feeds this forming press at Sylvania Electric Products, Inc., New York. The machine turns out parts for television cabinets that require no further painting or finishing. This eliminates the cost of flammable chemicals needed for spraying, and reduces insurance costs at the same time.

Mircacoil, developed by Enamelstrip Corporation (Allentown, Pa.), comes in many colors and designs. The plastic coat is abrasion-, steam-, and water-resistant. Forming operations don't affect the surface. But the material can't be welded, a disadvantage that recent advancements in chemical bonding methods may overcome. Coils are available in widths to 48 inches for direct feeding to production machines. Until now, pre-coating techniques have been limited to sheet steel.

Paperwork Mountains Succumb to EDP

"Cape Canaveral calling Norfolk (Va.) Naval Supply Center. We need part number 531 for Polaris missile. You have it in stock?"

This is a routine query for the 220 electronic computing system (Burroughs Corporation, New York) installed at the Center. In about 8 seconds after receiving the inquiry, the computer has an answer. And in a little over a minute, the caller has received a status report on the part he needs.

This system, a combination of electronic data handling, automatic computing, and magnetic tape filing, is solving a giant paperwork headache at one of the largest military supply centers in the world.

One of the system's features is a telephonic inquiry unit which permits operators (photo, foreground) to process telephone orders. The handwritten interrogation form, containing the part's identification number, goes to the Flexowriter operator (second row) who punches out the number on paper tape. Here machines take over to check the status of supplies from the 575,000-item inventory stored on magnetic tape. Before the computer was installed, stock status balance cards were maintained for each item.

The system also boasts decision-making ability. It can automatically make routine decisions on requisitions, which frees the Center's skilled personnel for other work.

Obsolete Plant Made Good as New

Would you like to spend a dime to save a dollar? That's roughly what Smooth-On Manufacturing Company decided to do for its Jersey City, N. J., plant.

Of the company's three interconnected buildings, two dated back to before the turn of the century. These buildings were just not compatible with today's operations. But faced with the choice of either constructing a new plant or modernizing existing facilities, Smooth-On chose the latter.

Result: Actual modernizations cost roughly $39,500 compared to the estimated $330,000 cost for a new building. The plans, proposed by Engineers, Inc., Newark, and adopted by Smooth-On, were aimed at solving the most immediate problems at the old Smooth-On facility. They covered these three areas:

• **Shipping and receiving.** Here excessive congestion hampered loading and unloading of trucks. A new dock of unusual design solved the problem. Its entrance receives trailers at roughly a 40-deg. angle rather than the conventional straight-line entrance. This angular design provides two benefits. First, it minimizes cost of construction of the new dock and takes up a minimum of needed floor area within the plant. Second, a 35-ft.-long trailer can reenter the dock without totally blocking the 30-ft.-wide access street behind the plant.

• **Offices.** A new, bright reception area now greets visitors to the plant. Its glass wall creates the illusion of space. There are private offices and a conference room of the latest design. And the entire office area has been air conditioned for employee comfort.

• **Manufacturing.** A modest relocation program permits Smooth-On to take better advantage of its three buildings. All processes for the manufacture of epoxy resins are now in the most modern building which is of concrete construction. This reduces the fire hazard that would exist if older buildings of wood construction were used for the purpose. Now the two older, wooden buildings are used to store containers and raw materials and for shipping, receiving, and office functions.

Jets, Filter Pads Keep Engines Clean

One of the biggest problems in gasoline engine manufacturing is to keep metallic particles and chips from getting into the engine during assembly. And to remove those that do. D. W. Onan and Sons, Inc. (Minneapolis) managed to solve the problem by building a 14-jet high-pressure oil washer right into the final assembly bench shown in the photo. And it's using throw-away filter pads to catch any contamination that does get through.

Jets in the washer are fed from a 65-psi. hydraulic pump driven by a 2-hp. motor. Jets are flush with the steel bench surface and are surrounded by a drainage sump which returns the oil through filters for recirculation. Just before the base is put on the engine, the unit is slid over the washer, clamped in place with built-in toggle clamps.

Each of the jets is positioned so its stream is directed at a place where particles might collect. In 45 seconds even the most tightly lodged chips have been removed.

During the last stage of assembly, circular filter pads (cut from milk filters) are slipped over the engine's oil pump intake screen. Pads are held in place with a re-usable spring steel wire clip, fastened to a short length of chain.

After each engine is given its break-in run on the test floor the inspector removes the filter, clip, and chain through the crankcase oil hole. A quick look tells him if any dirt or metal is present. If there is none, the unit is passed after flushing. If contaminated, the engine may need to be torn down for cleaning. Even then, the pad has prevented the particles from circulating through the engine and damaging bearing surfaces or restricting oil passages. And the density and size of the contamination provides a statistical quality control record—as well as the clue to where to look for the trouble source.

There are two other ideas in the photo above that may be worth adapting. Onan uses heavy-duty peg board on the assembly benches. This makes it easy to hang tools, gaskets, or awkward shaped subassemblies. And parts are kept in standard-size stamped steel boxes that hang by means of two clips welded to one edge on rows of 3/16x2-in. steel angles. These are mounted along the bench back supports. Any size box can be used. The method is cheap and easy to adapt to any type of assembly bench.

Source: R. D. Aspelin, Methods Engineer, D. W. Onan and Sons, Inc., Minneapolis, Minn.

Sampling Jobs

Work sampling has recently experienced phenomenal growth. Most commonly it's used to observe people working in a restricted area. Thus, making instantaneous observations of individuals at random intervals of time caused little or no difficulty because these people could ordinarily be found in the area assigned. Or, if they were out of the area, it was not too difficult to find them and make the observation.

But what happens when you try to apply work sampling to situations where it's difficult to know where the individual is? The Stix, Baer & Fuller department store in St. Louis faced this problem. It wanted to obtain information on handlers in its old warehouse. This was needed to properly design a new warehouse—to help establish proper work methods, evaluate alternate layouts, determine proper handling equipment, establish manpower requirements, and the like.

The old warehouse was made up of four multi-story buildings. These structures had over 250,000 square feet of floor area on a total of 19 floors. (Individual buildings varied from two to eight stories.) Of the 43 handlers in the warehousing operation, each was assigned a specific area of operation. However, in the course of performing work these men moved freely throughout the whole warehousing area. And some of the 43 men were shifted to different areas as workloads varied from day to day.

In applying work sampling to this unusual but not unique situation, the study was started in the conventional way. First, basic objectives were established, people under observation noted, rough observations of the work made, a list of activities made, and a proper observation form developed. In this study, management decided to observe all 43 handlers. One analyst was assigned to make the observations during a six-week period.

After these basic preliminary measures, the following six-step special procedure was used to complete the study.

1. Each floor area in the warehouse was given a number between one and 19. Then a table of random

# of Wandering Workers

numbers was used to set up the rotation of areas for observation.

2. The analyst observed areas in random order. This assured random observations of persons working in the warehouse. It's the key to using work sampling in this unusual situation. It substitutes use of random observations of areas for conventionally used random observations of people. The analyst merely goes from one area to another following the random selection of area numbers. Thus, the observation route is not established in advance but is really a random route.

3. Activities observed and recorded on the observation form tell what each handler was doing when first seen in the area under study.

4. In the area under observation, every possible nook and cranny was checked carefully to make sure everyone present was covered. Obviously, there was no way of knowing how many people were in a particular area at a given time. Thus, a thorough check was essential.

5. The analyst did not record the activities of persons he saw while walking through areas on his way from one random observation area to the next. The only observations recorded were those made on people in the area assigned by random numbers. This was done because the analyst encountered many handlers as he walked through from area to area. To include the preponderance of observations made in common walking and working areas would have distorted the final results.

6. The validity of the results of the warehouse study was finally checked for accuracy in two ways. First, the number of observations made on persons working an identical number of hours was compared. Over the six-week period total hours worked by each handler varied somewhat because of absenteeism, vacations, and holidays. And second, the ratio of number of hours worked to number of observations was checked. Here, it should be noted, all ratios were checked against the one for the maximum number of hours worked and found to be within a satisfactory allowable range. Results of both checks showed a definite similarity of observations per person.

Naturally both these checks are rough and relatively inexpensive. (A thorough and theoretical check of results would involve complete all-day studies of each individual in the warehouse and would be overwhelmingly expensive.)

The real significance of the two checks is that one of the prime bases of a regular work-sampling study was not violated by changing the focus from random samples of time to random samples of areas. The two checks show that an approximate equal number of observations was made on each person even though it was the area that received the random observations.

Source: Gerald Nadler, Head, Department of Industrial Engineering, Washington University, St. Louis.

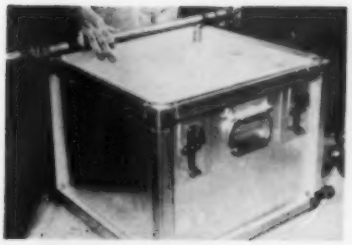
Talking House Organ

A talking house organ is speeding up employee communications at Rockwell Manufacturing Company, Pittsburgh, Pa. It's done by means of a closed circuit phone system that broadcasts company news.

It works like this: Each morning an employee records the news on an automatic answering device (illustrated above). The device is rented from Bell Telephone Company for $10 monthly. Then, to hear the day's news, Rockwell workers just dial a special number and listen.

Material runs the gamut—from latest promotions to vacation schedules, to cafeteria menus, to the scores of girls' basketball games. Broadcast time is one minute.

Company officials stress that the system will supplement—not replace—bulletin boards and personal letters. The latter are needed for detailed information.



Adhesive Bonding Cuts Costs Sharply

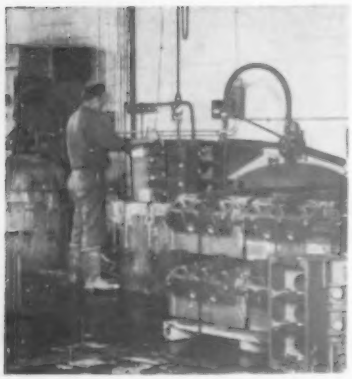
Zero Manufacturing Company (Burbank, Calif.) is saving 25¢ out of each dollar formerly spent to build metal, watertight shipping containers. How? By using epoxy adhesive bonding for assembly.

The containers consist of a framework of slotted aluminum extrusions, with sides, tops, and bottoms of stressed aluminum sheets. Extrusions are cut to length. Then slipped over three-prong corner castings with integral cast reliefs. Reliefs are filled with epoxy adhesive EC-1386 (Minnesota Mining and Manufacturing Company, St. Paul).

When the framework has been assembled, the slots are filled with epoxy, and stressed aluminum sheets are inserted. The entire container is squared and banded with a steel strapping tape to hold it in shape. Then it's placed in an oven at 350 F. for one hour of curing.

Use of this method has paid off in the following ways:

- Complicated designs for welding and bolting are not required.
- Thinner sheets of aluminum can be used. This is due to the uniform stress of adhesives, rather than to former stress concentration at points of fastening.
- Close tolerance machining of mating parts is not necessary as the adhesive fills voids.
- Adhesive provides an effective seal at all seams at the time of bonding. This eliminates the time and cost of separate sealing for water tightness.
- Skilled labor is not required for bonding operations.
- Large capital investment is not required for adhesive bonding equipment and operation.
- If there is need to disassemble the container, the assembly has only to be heated to a high temperature. This causes the adhesive to lose strength makes disassembling easy.



Impregnation Seals Pores in Castings

Castings found to leak because of microscopic pores in casting walls are being reclaimed by Prenco Products, Royal Oak, Mich. Fully machined engine block assemblies are being salvaged at the rate of 24 per hour through an impregnation operation.

Here's how it's done: Blocks are loaded, three at a time, into two autoclaves (photo above). Six blocks go into each machine. The casting pores are opened by creating a high vacuum in the autoclaves and holding it for 12 minutes. Heated Polorox C sealant is then added. Pumps are reversed, and pressure of 100 psi. is applied in the autoclave for another 12 minutes.

The sealant is then drained. Castings are removed from the autoclave, rinsed in cold water. Surface areas are immersed in a rust inhibitor. Cylinder bore is rubbed with oil to impregnate the surface. Crankshaft bearing cap retaining bolts are loosened to prevent freezing when the sealant sets.

To assure uniform consistency of the sealant, sedimentation and specific gravity tests are performed on it periodically.

Dialing the Mail

Dial a number and send mail anywhere in the building. It will be just that simple when a system of controls designed to coordinate all conveyors is installed in the 52-story Union Carbide Corporation skyscraper in New York City.

Here's how the system works: The Maitrol mail conveyor line, made by Maice Electronics, Inc. (Minneapolis), gets underway when an operator dials a floor selector number. The control then impresses a coded address system on the mail basket rack, and sends it on its way. The unit is rejected by all receiving stations until it reaches the one that responds to the code. There the magnetic system triggers a mechanism to remove the carrier basket from the conveyor line.

1

Pipeline Dog Tags Aid in Maintenance

Tagged clamps are solving maintenance and safety problems at Union Oil Company's Wilmington, Calif., refinery. Could work for you, too.

Here's how: The stainless steel clamps, manufactured by Aeroquip Corporation (Jackson, Mich.), provide a guide to pipes needing repairs. Maintenance crews attach 2x4-in. flags to the pipes by sliding them on corrosion-resisting bands. The bands are then fastened to the pipeline near flanges that are to be disassembled. Flags have written instructions or code numbers corresponding to crew's worksheets. When crew arrives, their work is laid out for them, eliminating costly mistakes and delays.

Some of the flags go back to the shop for repainting for subsequent use. Others never come off the pipelines. These serve as permanent identification or warning signs. They alert workers when dangerous acid is present and when face shields should be donned.

These clamps fit any pipeline from 2⅝ to 16 inches in diameter. They adapt to any hose duct pipe strap hanger, mounting bracket, or irregular-shaped applications. They withstand clamping pressure up to 650 pounds.

YOU BE THE ARBITRATOR

Continued from page 152

The award—The arbitrator said that the rights Ralph acquired while within the bargaining unit survived his transfer to the foreman job. The grievance was therefore arbitrable. On the merits of the case, he concluded that the company's objection to Ralph was as a *foreman*, not as a *worker*. He therefore directed that Ralph be returned to his old job.

Caution: The award in this case is not an indication of how other arbitrators might rule in other apparently similar cases. Arbitrators do not follow precedents. Each case is decided on the basis of the particular history, contract, testimony and other facts involved.

Extension Switch Speeds Shearing

Cutting 12-ft. metal sheets used to be a two-man job at United Controls Corporation, Seattle. But now it's a one-man operation. The reason is a hand-held remote control. With it, even the lone operator can do the job faster. Switch circuitry was assembled by plant personnel at a cost of less than $200.

In addition, the switch makes back-shearing a one-man job. Shearing from the back is required when flanges or other parts must be trimmed after a previous bending or braking operation. And now the shear operation is safer because two workers don't have to coordinate their actions.

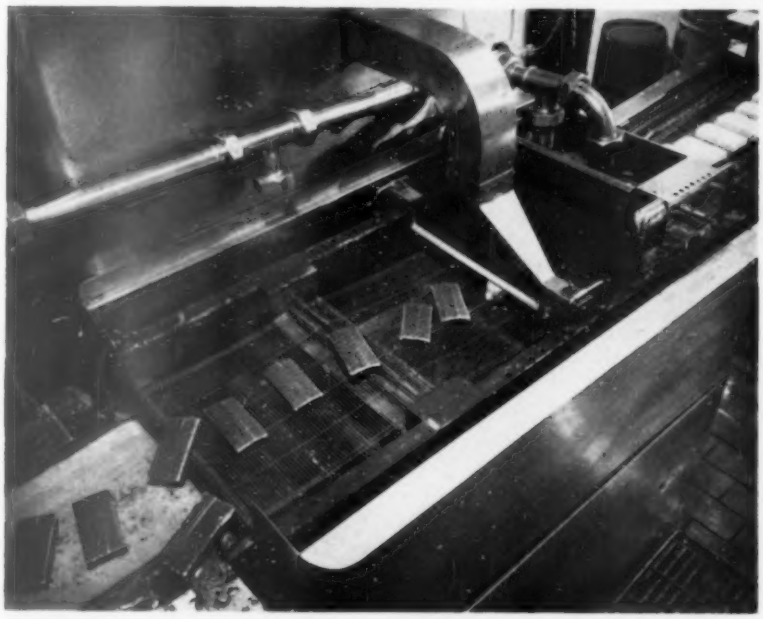
Length of cut is set in advance of shearing. Thus the operator stands at the most convenient point, controls the operation with the switch regardless of sheet length.

first in silicones

Dow Corning

SILICONE NEWS

production and maintenance edition · No. 33



DURABLE, STICK-FREE CONVEYOR

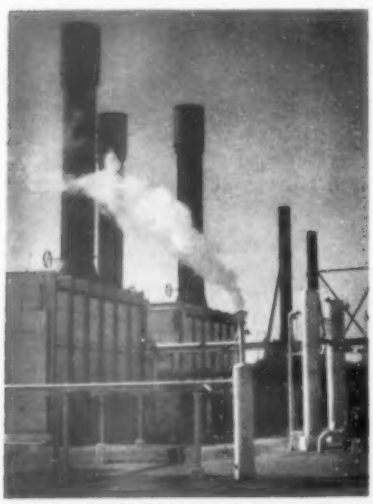
Ever wish for a materials handling belt that has a "release" surface? . . . one that can tolerate heat and cold? If so, here's a helpful hint.

The McDonald Ice Cream Company of Saginaw, Michigan, makes Eskimo Pies. After the ice cream is formed into blocks, a coating of hot chocolate is applied by the machine shown. Then, a conveyor belt (left) takes them through a re-cooling tunnel before packaging.

McDonald's found that conventional rubber belts offered two difficulties. (1) The chocolate stuck to them; necessitating the use of water to obtain release . . . an undesirable condition. (2) Belts failed rather rapidly due to the service environment. So McDonald's belt supplier, Hewitt-Robins of Buffalo, engineered a new belt of Silastic®, the Dow Corning stick-free silicone rubber. It works wonders.

Here's what McDonald gained. *Savings*: The belt of Silastic costs only 20% more, and lasts twice as long. *Savings*: Because the chocolate releases easily from Silastic, few bars need re-coating, and the syrup now goes 15% farther. *Savings*: Less labor goes into the operation, because it is no longer necessary to turn bars over to get adequate coating, no water is needed for release.

Summing up: Silastic proved a big help all around. If you have a similar problem, ask your rubber fabricator to engineer a part from Silastic. *No. 747*



KEEPS AWAY RUST AT 500 F

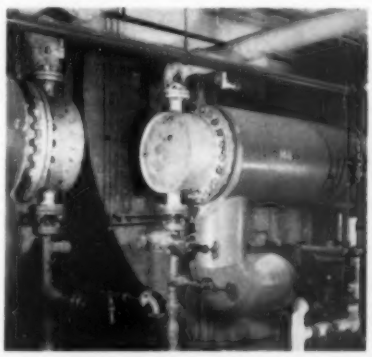
Any good paint will help keep rust from forming on metal surfaces. But what do you do when the paint burns off? Here's one good answer.

Stack temperatures on absorption oil heaters at the Snyder Gasoline Plant, operated by the Sunray Midcontinent Oil Company, run to approximately 500 F. To avoid the cost of repainting frequently — every time the conventional-type paint burned off — Sunray sought a more lasting finish.

They got it from the Cactus Paint Company of Big Spring, Texas. Based on a Dow Corning silicone resin, this paint is especially formulated for duty up to 500 F.

One of the stacks at Sunray was sprayed while hot, over two years ago. The others were sprayed later while cold. All are now in excellent condition, with no signs of rust in evidence. Before the silicone paint, nothing worked satisfactorily. Contrast this with the present record of over two years of operation without coating failure!

Whether applied to hot or cold surfaces, the Cactus paint forms a good, reliable coat to prevent corrosion, and easily outlasts conventional organic paints "at temperature". Do you have some piece of hot plant equipment that needs a lasting paint job like this? *No. 748*



End Bolt Binding

This Midwestern plastics company found a way to keep bolts on equipment from sticking. As a result it has reduced maintenance time and costs.

It was annual tear down time at the company. Workmen, in trying to loosen bolts exposed to high heat, often twisted the bolt heads off completely. The bolts had to be drilled out, delaying tear down time and adding to costs. *(Cont. Pg. 2)*

A FASTER "SOFT-SHOE" STEP

The right release agent is often the "sole" difference between a modestly fast production line and a real "stepper". For instance . . .

The Genfoam Shoe Co. of Nashville, Tenn., a division of Genesco, Inc., makes canvas shoes. The rubber soles for these shoes are sponged and vulcanized onto the shoes in metal plate-type molds. Naturally, being so dependent on good appearance, shoes require the cleanest possible release from their molds. Until recently, an emulsion plus talc was the release agent used, and it worked fairly well but still left a lot to be desired.

Then the Genfoam Company tried Dow Corning 20 Compound. They adopted it *immediately*. Why? This silicone release agent doesn't cause the rubber to defoam during vulcanization as did the other release. Soles release more cleanly. The Dow Corning Compound needs to be applied only twice in a continuous 24 hour work day instead of after every cycle. The use of talc is minimized . . . and the molds don't require any cleaning between changes of sole colors.

The end result of all these advantages is a whopping 420 more pairs of shoes produced per day. But there's more.

Production's so much easier, so much smoother, so much cleaner, the Genfoam Company management feels that their happy employees "wouldn't work without it". Have you investigated Dow Corning release agents? . . . they might make this big a difference in your plant, too! *No. 750*

END BOLT BINDING *(Cont.)*

Enter: Dow Corning 41 Grease, a silicone lubricant.

Now plant maintenance men apply a light coating of this material to the bolts at annual tear down. Because silicones resist heat and won't gum up, the bolts can now be removed with ease. Even those located on the boiler clean-out flues and heat exchanger headers don't seize.

Since they started using Dow Corning 41 Grease, tear down time has been noticeably reduced, maintenance costs substantially lowered . . . the battle with sticking bolts won. *No. 749*

new literature and technical data on silicones

Better Brick Buildings—This is a 14-minute, full color documentary describing Silaneal, the only brick treating material proved safe in SCPRF-prescribed wall tests and by 3 years experience in the field. You can witness methods of application and actual buildings protected by invisible Silaneal that reduces ground stains, minimizes efflorescence, makes lay up easier and faster, and keeps walls clean and beautiful longer. Arrange for a free showing by writing for *No. 751*

Handle The Stickiest Materials — Packaging materials coated with Syl-off peel away easily from adhesives, rosin, raw rubber or asphalt — even after long-term storage under adverse conditions. Production and handling costs can be cut, time saved, waste reduced and tempers subdued according to this 4-page, illustrated brochure. A list of Syl-off coated packaging distributors is included with . . . . . *No. 752*

Performance-Proved Dow Corning silicone lubricants can help you solve problems created by adverse operating conditions. Designed for reliable service over wide temperature spans, specialized Dow Corning silicone lubricants are used on equipment ranging from freezers to core oven conveyors — at temperatures as low as −100 F, as high as 500 F. Properties and applications for silicone oils and greases are compiled in an 8-page brochure. . . . . *No. 753*

How and why you can cut costs and reduce downtime with silicone-insulated electrical equipment available today is humorously and technically depicted in this easy-to-read 8-page reference. It tells what motors and transformers to select for what purpose to gain the unique advantages only silicone insulation provides. To learn of the savings possible in your plant, circle *No. 754*

You Can Foil Foam — Dow Corning defoamers kill foam that develops in the processing of chemicals, petroleum, asphalt, paper, textiles, food and drugs. A pamphlet indicates the minute amount of silicone defoamer required to gain added working space, decrease production time and trouble in metal working and each of the above processing industries. Investigate the savings made possible with defoamers. *No. 755*

Dow Corning Corporation, Dept 5102, Midland, Michigan
Please send me: 747 748 749 750 751 752 753 754 755

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Pinkerton's modern security methods approach the problem of security from other angles besides that of manpower. As the oldest and largest in the business, we provide a complete security service, superior in quality and reliability.

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F-1

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COVER STORY

Don't Let Your Plant

GO UP IN SMOKE

Before the alarm goes off, read about this low-cost, flexible control plan. It covers fire—and other plant emergencies too.

The alarm phone jangles in the plant firehouse. The fire-truck driver on duty doesn't even stop to pick it up. (He saw a visiting warehouse man grab it.) Instead, he races for his truck. While the engine is turning over, he switches on the truck radio and learns there's a fire in the food-loading and storage area next to the cafeteria. At the same time, other key people in the plant grab for their alarm phones, hear the same message, and, if they have a role to play, drop their work and head for the fire.

Two minutes after alarm—Driver and truck are at the scene of the fire—a quarter-mile from the firehouse. One of the plant emergency crew close to the fire has already removed the hydrant nozzle cap and is ready to open the valve. Hose is strung out.

Three minutes after alarm—The following people are in the emergency area:

One fire-truck driver.

One plant fire chief.

Four fire fighters.

Five maintenance men—two on the roof checking ventilation, three on the loading-dock apron.

One nurse.

One bystander—a visiting vendor's salesman.

One associate editor of FACTORY (he's reporting the action).

Each of these men is purposeful and busy—no shouting, no arm-waving, little or no talking.

Ten minutes after alarm—Fire is out. The nurse, after recording his name from his ID card, has examined the lone victim and moved him to a stretcher. The plant ambulance picks him up and rushes to the hospital.

PLANNING for emergencies at IBM-Kingston starts with the Emergency Action Committee. Here, this management group is mapping evacuation routes from the plant's paint department.

PREPAREDNESS requires neat and convenient storage.

EQUIPMENT—like this electric truck—is up to date.

TRAINING means regular workshop sessions with key plant personnel. Here, the fire and rescue squad chief teaches a class use of the fire extinguisher. Students are department managers.

The area clears of smoke. Fire-fighters' oxygen masks are put away. The fire truck turns and heads back to the firehouse.

What you've just read is what happens when there's a secret fire drill at the Kingston (N.Y.) plant of International Business Machines Corporation. IBM-Kingston is equally well set up to handle any other emergency—explosion, power outage, traffic accident, even local wartime emergencies.

Its procedures and equipment reflect corporate-level planning, narrowed down to the particular needs of any single plant in IBM's far-flung manufacturing family. These procedures reflect training and discipline—assigned people doing their assigned jobs swiftly and surely, without having to stumble over gawking bystanders. They also reflect the freedom of judgment and action encouraged by IBM among its management people and employees. The man who spots a situation or event decides whether it is an emergency. If it is, he starts action. Good judgment, swift action, and effective emergency procedures are the result of sound training.

What does this mean to you? Just this: IBM's procedures are yours for the taking. Whether your plant is big, small, or middle-sized, here's help in setting up your own plan for handling plant emergencies.

If you model your plan after IBM's, it will be:

- **Effective.** No time lags. Minimum wasted effort.
- **Flexible.** And wide-ranging. Every predictable emergency covered.
- **Low-cost.** No extra people. Minimum administrative time.

Keron O'Neil, manager of employee services at IBM-Kingston, spends less than an hour a week as emergency-action coordinator. The local manual for emergency procedures is an unillustrated looseleaf notebook. The people who perform emergency action are regular production, clerical, or maintenance employees. This emergency plan doesn't even call for extra security people—just the normal force of guards, watchmen, fire chief, and fire-truck drivers.

START WITH A SOLID BASE

Starting point for IBM-Kingston (and other IBM plants, laboratories, and branch offices across the country) is a 5-page directive called "Corporate Instruction." The over-all program of which this operation is a part is administered by IBM's Corporate Security Department headed by George H. Simpson.

Turn the page

replace with RCA

RECTIFIER TUBES

for long-term reliability

Your RCA Industrial Tube Distributor is the man to call when you need replacement rectifier tubes. He can supply all standard types—vacuum, gas and mercury vapor—in a wide choice of power ratings for every industrial purpose.

The built-in reliability and long life of RCA rectifier tubes pay-off profitably in reduced downtime and lower tube cost per hour of operation. Always specify RCA and get top value for your tube dollar.

Remember—your local RCA Industrial Tube Distributor is as close as your telephone. Call him for fast, efficient service whenever you need replacement tubes.

RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

DON'T GO UP IN SMOKE

Begins on page 162

This Corporate Instruction states corporate policy for emergencies and recommends basic procedures for plant operating management in these seven areas of activity:

1. Administration—Name emergency coordinators, make them responsible for the over-all plant program. To help the coordinators, set up an advisory staff representing the various departments, plant buildings, or offices involved. Instruct coordinators and staff to do these things: set up among themselves an order of succession so that responsibility can be passed along in the absence of any key man; provide training for fire, first aid, rescue, damage control, and evacuation; and select a suitable off-site location for use as temporary headquarters.

2. Personnel—"Locate, account for, communicate with, and render assistance to employees both at home and at work," says the instruction. At the plant level this means, for instance, emergency payrolls and financial help, duplicate personnel records, evacuation, employee and public information, and manning of emergency headquarters.

3. Emergency services — Cover everything from fire in a waste basket to an arcing high-voltage power line. Train and assign people in plant protection, fire protection, vital services and supplies, alarm systems, rescue, damage control, first aid, emergency equipment, transportation, communication network, medical and nursing supply.

4. Records—Store all important records away from plant. Consider microfilm, other kinds of duplication.

5. Production—If possible, arrange secondary sources of materials and alternate manufacturing facilities. Production continuity is vital.

6. Restoration of facilities—To speed restoration, see that duplicate plans and specifications for the existing plant are stored and accessible elsewhere.

7. Reporting—Report emergencies immediately to responsible executives, and follow through with detailed information as available. Offer every possible help to IBM employees. Also show consideration for customers and the public.

There's one more important item

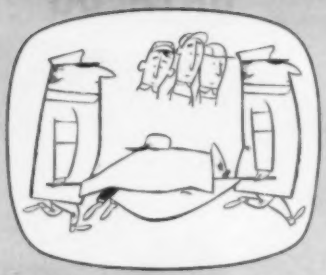
4-Way® Safety Plate Presents

A GRIPPING TALE OF LIFE ON SKID ROW

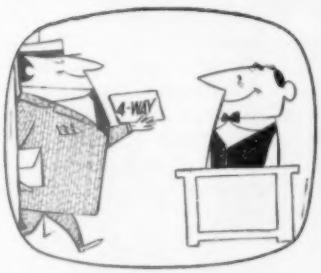
THE BIG SLIP!

Enter our star—Benny Bandsaw. Great guy on the production line. Mr. America to his wife and kids. Every day Benny and millions just like him, go to work on Skid Row.

Watch it, Benny—look out! Wow! Too bad. On Skid Row, what *on the surface* appears to be a safe place to work, may turn out to be a surprise for Benny and his buddies.



And thus, another Skid Row tragedy. Our hero gets the slip and the result is *lost* time...*lost* production...*lost* safety records...and *lost* money.

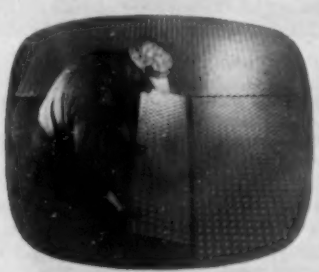


But...help is at hand. Enter 4-Way salesman...J. W. Goodheart...genial representative for versatile, slip-resistant 4-WAY Safety Plate!

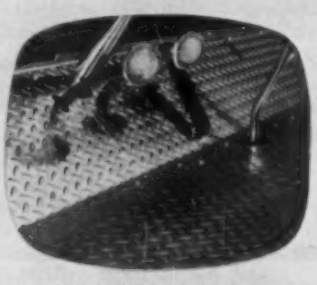
Solution? Yes, Sir! Industrial plants, stores, offices, schools, hospitals, all over the USA, use 4-WAY...find it SAFE, STRONG, EASY TO CLEAN, ATTRACTIVE!

What's more, 4-WAY can be flame cut, sheared, sawed, drilled, punched, welded, formed...it is simple and EASY TO FABRICATE!

FIRESAFE, too! 4-WAY is an added safeguard for your people, your plant, your equipment and stock...and my how those insurance men appreciate it.



When it comes to installation and maintenance, no special tools or skill is required. Inland 4-WAY Safety Plate is one of the most ECONOMICAL materials you can use!



And don't overlook the advantages of super-strong, mighty-attractive, 4-WAY on the products you make. It can add an important merchandising feature that will help boost sales.

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4-WAY® SAFETY PLATE

Available at your Steel Service Center or from Inland in a wide variety of patterns and sizes.

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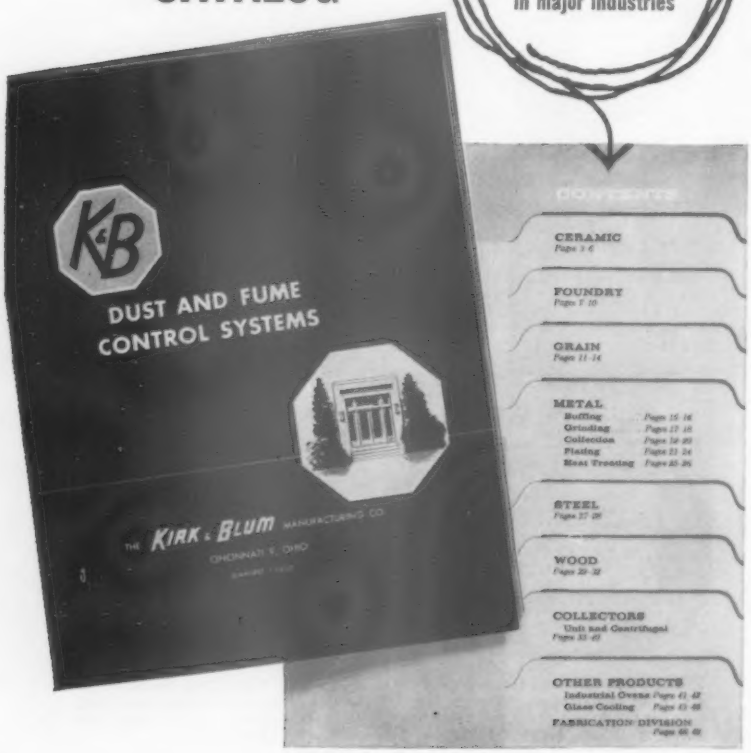
NEW KIRK & BLUM

Dust & Fume Control CATALOG

52 pages showing 60 different installations in major industries



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See how Kirk & Blum provides one source for the complete operating system—design, fabrication, installation—*one* undivided responsibility.

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Begins on page 162

in the Corporate Instruction: Generally, IBM will not run major relief efforts in local disasters. But if a national relief agency moves in on a local disaster, IBM may supplement its regular national donations with local contributions. Add up the effect of this "Corporate Instruction" and you get this:

- A broad base on which each local IBM manager can build his own detailed plan.
- Assurance that no local manager will overlook any likely emergency or any important aspect of handling emergencies.
- A pattern that means fewest injuries to people, least damage to plant and facilities, and swiftest return to full production.

BUILD ON LOCAL NEEDS

Return for a minute to the fire drill at the beginning of this article. Everything done in that drill had its ultimate origin in the Corporate Instruction. Yet the Corporate Instruction deals only with principle and policy. What, then, was the source of the detailed plan that made the drill at Kingston come off so well?

The source was local plant management. Like other IBM local managers, managers at Kingston took principles and policies from the Corporate Instruction, applied them to local facilities and conditions, and produced their own manual of detail and procedure, especially tailored to the Kingston plant.

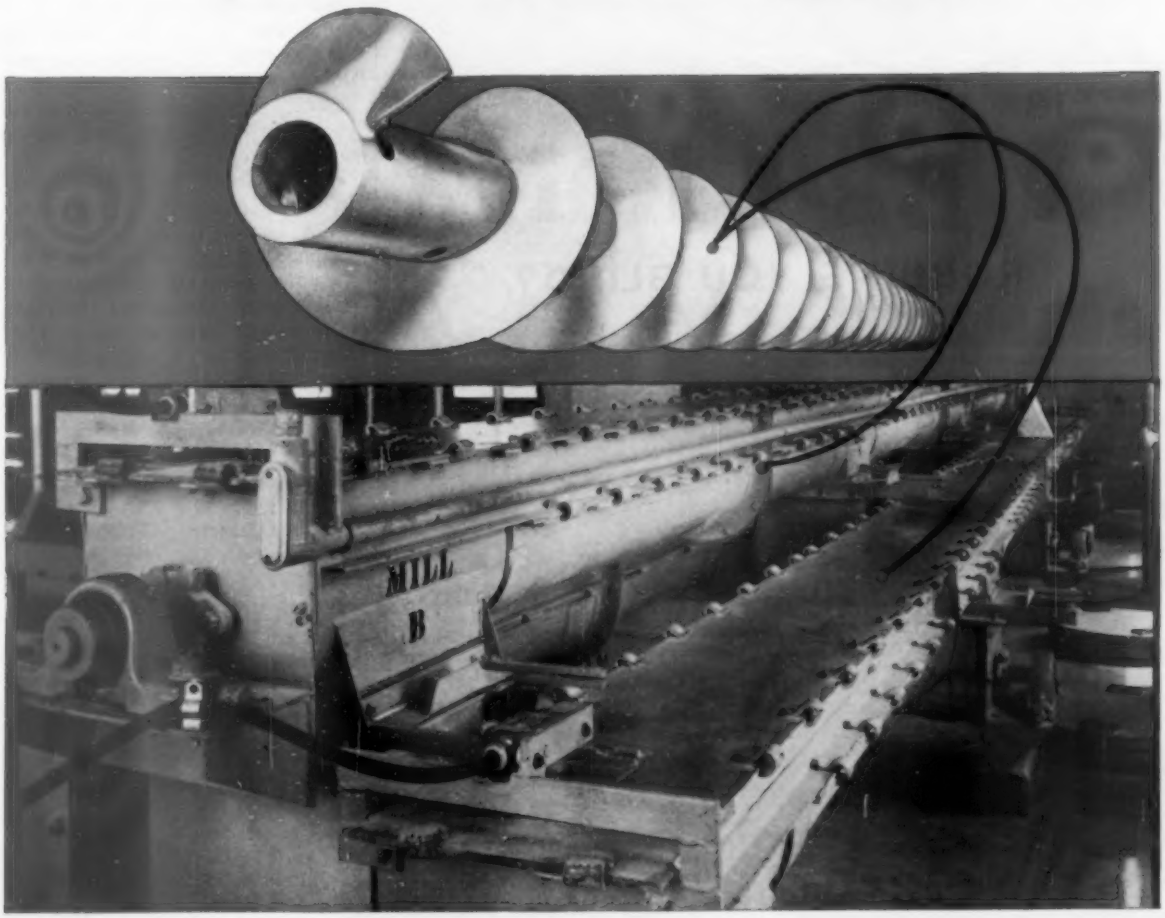
Look at the IBM-Kingston manual and you'll find (to mention only part of its contents) a complete list of facilities and equipment for communication, rescue, first aid, medical care, damage control, and restoration of plant activity. You'll find emergency responsibilities assigned —and names given. You'll find key phone numbers, codes, and signals. In fact, you'll find all the latitude needed to handle any emergency in the plant, on the grounds, or in the neighborhood.

Look at some of the equipment and facilities available for fire—and for emergencies of all sorts:

- **Smoke bomb.** This was used to simulate the fire. IBM-Kingston uses

Why a system of LINK-BELT screw conveyors

FITS LIKE A GLOVE AND WORKS LIKE A CHARM



- **Thorough engineering analysis of all conditions**
- **Full responsibility for satisfactory performance**
- **Unbiased selection from industry's most complete range of components**
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With Link-Belt, screw conveyor engineering includes far more than just supplying a suitable product. All related aspects of your production are considered—including prior and subsequent handling, plus integration with other equipment. And because Link-Belt handles all details from specification to erection, it means a better-working system with less work for you.

Continuous product improvement and development by Link-Belt has produced industry's widest range of components for screw conveyor applications—various types of flighting, gates, troughs, drives . . . plus a new line of ball and roller bearing equipped accessories.

Link-Belt specialists will work with you to determine the feasibility of adapting screw conveyors to your operation. Call or write your nearest Link-Belt office for full details. Ask for Book 2989.

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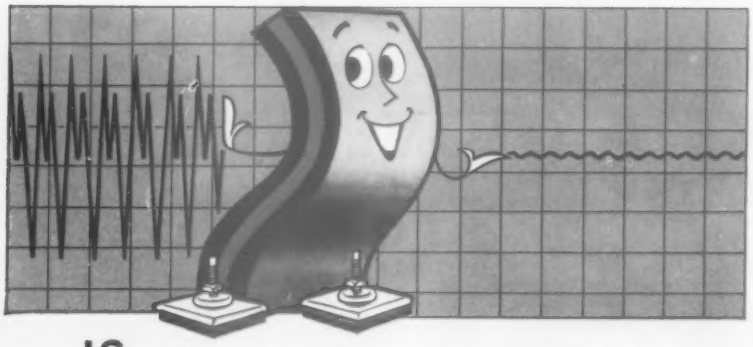

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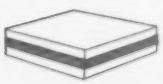
VIBRATION

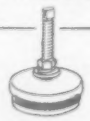
ROBBING YOU BLIND?

Transmitted vibration in your plant or office is a universal culprit that keeps attacking your costs and operating efficiency in a hundred ways . . . unless checked at its source.

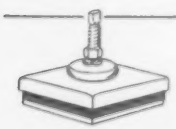
Unisorb machine mounts — either pads or Level-Rite devices — reduce up to 85% of this transmitted vibration and provide a practical, low-cost solution to almost all vibration problems. Unisorb Vibration Control reduces noise, worker fatigue and human inefficiency. Unisorb will reduce maintenance of buildings and machines, cut down-time and simplify machine installation. In addition, tests show that Unisorb permits running machines at higher speeds and closer tolerances for increased production and improved quality.



Unisorb Mounting Pads
Unisorb pads are the basic vibration control unit, identified by the red centers and brand mark. Available in a wide range of densities and thicknesses for proper application. Saves up to 80% in installation time and costs.



Unisorb Level-Rite 200
Unisorb Level-Rite "Junior" has been especially designed for light machines, air conditioners, business machines and similar equipment. A low cost, precision leveling device and vibration control unit, with loading limit of 200 lbs. per unit. Ideal for original equipment.



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Unisorb Level-Rite is a universal, self-contained leveling device for all types of machines. Fast, simplified way to achieve and hold precise level. Available with exclusive screw-post design or as a basic mounting plate for use with built-in leveling devices.

Remember — to simplify installation, improve performance and control vibration . . .

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FEB-61

DON'T GO UP IN SMOKE
Begins on page 162

a non-toxic, non-explosive bomb that emits a dense white smoke for about five minutes. It's placed in a tin can or bucket and the fuse is ignited. For this drill two bombs were used. They filled a 3200-cu.-ft. room with smoke, thus made the drill realistic. (To simulate an outdoor fire with accompanying black smoke, IBM-Kingston ignites old packing cases that have been doused with crankcase oil.)

• **Phone circuit.** The call to the firetruck driver came through an emergency circuit in the in-plant dial telephone system. His phone is red —one of many red phones, wall or desk models, throughout the plant. Red phones have no dials. They ring, all together, whenever anybody dials 333 on any ordinary phone in the plant. Each keeps on ringing until somebody answers it.

On the central phone switchboard (at the main reception desk, manned 24 hours a day) there's a light for each red phone. All these lights flash on when 333 rings, go out one by one as the red phones around the plant are lifted from their cradles. This way, the chief telephone operator, as well as the receptionist, knows who has or hasn't picked up his red phone. The special phone circuit enables anybody in the plant to reach all emergency stations without using normal phone circuits, which may be busy, or the public-address system, which would alert everybody instead of just the key people.

One more word about the red phone circuit. Suppose the nurse faces an emergency in the first-aid room—doesn't have time to dial 333 and tell her story. She simply knocks the red phone off its cradle. The switchboard light flashes, a switchboard buzzer sounds off, the operator calls plant security, and help comes quickly and quietly. Similarly, any other person in the plant can signal the switchboard by knocking the red phone off its cradle. The switchboard operator will follow through on the regular phone system, finding out (if possible) what's wrong, and alerting those who should be alerted.

• **Firehouse.** It's manned around the clock—one man per shift. This man cleans and refills all plant fire

For more facts Circle 458 on Reader Service Card
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An open motor did what no other motor could.. in a mud bath

This Super-Seal motor with *Poxeal* insulation and protected bearing was not fouled by mud. An Allis-Chalmers customer, in a frequently flooded area, required a motor that could readily start even after prolonged immersion in mud.

The "dirtiest mud available" was used in conducting the successful tests in the A-C Motor Laboratories.

Motor user requirements like this form the basis for A-C pioneer-leadership in motor development. Motor buyer needs *created the most complete line of integral-horsepower motors in industry*. Induction, dc, wound rotor, synchronous, gear, tube-type and *Synduction* motors, and now *Super-Seal* motors! And, if these lines don't fill your need, A-C engineering excels in special design.

You can benefit from this pioneer-leadership by contacting your A-C representative or distributor. For more information, write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

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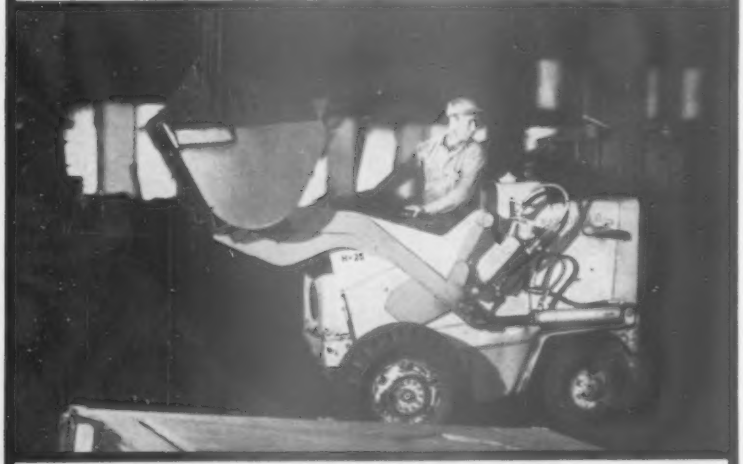
ALLIS-CHALMERS

A-1005

"This H-25 PAYLOADER®



saved costly plant revisions"*

*Says Robert Knight, Foundry Superintendent of Sumner Iron Works, Everett, Washington: *"We had reached a point in our operation where greater plant efficiency and productivity were necessary — either through plant revisions or improved materials handling. We tried an H-25 'PAYLOADER' and it gave us the productivity and economies desired without installing conveyors and other costly materials handling equipment."*

Sumner Iron Works has expanded rapidly through the years, taxing its foundry facilities considerably. Finally it reached a point where increased foundry productivity was absolutely essential and material handling improvements were required. Before taking this costly step, it was decided to see what a "PAYLOADER" could do to step up production within existing facilities.

The H-25 "PAYLOADER" was placed in service, bringing in sand from storage bins, filling the mixer hopper, and also dumping sand directly into the molds. Formerly this was a slow, laborious wheelbarrow and shovel job with long man-hour requirements. Now the "PAYLOADER" will pay for itself very quickly in savings alone — it has increased foundry production and has eliminated the requirements for other changes.

Whatever your material handling problem may be, there is a proper size "PAYLOADER" to do the job most efficiently.

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2-A-2

Begins on page 162

extinguishers (maintenance people bring them to him), dries fire hose, issues welding permits, and helps train firefighters. When the alarm sounds he scrambles aboard his red fire truck and speeds—alone—to the scene. There he is met by designated employees, who use the equipment on the truck, plus their own maintenance and damage-control equipment, plus equipment from emergency cabinets that are spotted strategically around the plant.

• **Fire extinguishers.** Fog nozzles were used for this particular drill. For fighting other types of fires in different locations, other kinds of fire-dousing equipment are available. (Incidentally, the drill revealed a pinhole leak in one of the hose lengths. This length was immediately retired from service—probably will be set aside for use in training.)

• **Firefighter protection.** While they searched the smoke-filled area, firefighters wore oxygen masks. (Review of the drill by the coordinator and the fire chief revealed that some of the men were a bit slow about properly adjusting their oxygen canisters. Remedy: more instruction before the next drill.)

• **Truck equipment.** In addition to hose, nozzles, extinguishers, axes, crowbars, and the like, the fire truck carries a portable 24-in. high-velocity electric fan mounted on a screened frame. In the drill the fan was used to eject smoke from the scene of the fire. Also on the truck is a portable gasoline motor generator set (110-125 volts, a-c, 60 cycles) for use when power is not available at the scene. (Other m-g units are available in the plant's maintenance areas.)

• **Victim handling.** The "victim" in the drill was placed on one of the stretchers spotted throughout the plant. The nurse examined him on the spot and put him into an IBM-Kingston ambulance for the trip to a local hospital, first recording his name from his ID card.

• **Water removal.** If this had been a real fire, the fog nozzles used in the drill would have left some water on the floor. Stream nozzles or sprinklers would have left even more. To remove water, even in small quantities, IBM-Kingston has hooked up a

ALL THESE... *full lines from Schrader...*

2 and 3-WAY VALVES (Roller Lever)
2 and 3-WAY VALVES (Angle Lever)
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NEW DELAYED BLAST VALVE

AND NOW...

NEW JIC SOLENOID AIR VALVES

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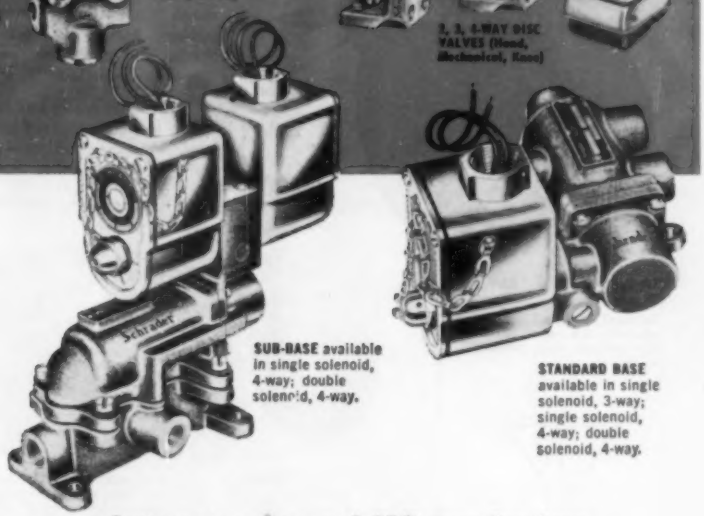

SUB-BASE available in single solenoid, 4-way; double solenoid, 4-way.

STANDARD BASE available in single solenoid, 3-way; single solenoid, 4-way; double solenoid, 4-way.

New JIC Solenoid Valves are compact, rugged, fast-and-easy to install. Roomy junction boxes fit space requirements with 90° rotation. Can be operated in case of current failure, by hand. Safe, recessed override button prevents accidental operation. Electrical system completely sealed against dust, oil.

Schrader's complete line of air valves allow you a freer hand in planning air circuits for your applications. Besides almost unlimited choice of size, style and actuation method, you get these extras in every Schrader valve you buy:

- All parts are designed for maximum air flow, longest service life; simplicity of replacement; interchangeability.
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- Performance has been proved by years of use in hundreds of plants. All Schrader Valves can operate with Schrader (JIC) Square End Cylinders perfectly.

Use the full Schrader line to do your air control selecting. Your Schrader distributor can help you pinpoint what you need. For more data write:

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QUALITY AIR CONTROL PRODUCTS

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FAIRBANKS
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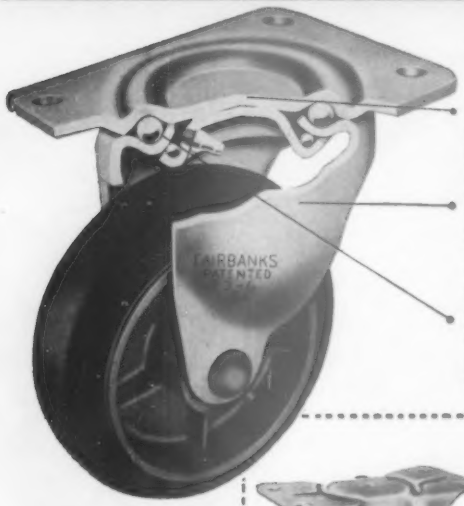

CHECK these unmatched advantages:

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- Patented leg design—spherical shape provides greater strength through better dispersion of shocks and overloads, easier swiveling under load.
- Larger raceways and ball bearings — perfectly aligned by the rigid welded structure — give faster, easier swiveling action.

Fairbanks Series "23" double ball race swivel casters, for medium duty, sizes 3" to 8".

Fairbanks Series "33" rigid casters, match Series "23" casters in height, sizes 3" to 8".

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Fairbanks Series "37" rigid casters match the Series "27" casters in height, sizes 6", 8" and 10"

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DON'T GO UP IN SMOKE
Begins on page 162

vacuum cleaner to a 55-gal. steel drum mounted on casters. The vacuum will pull up a thin film of water from the floor—even from cracks or seams in the floor—and discharge it into the drum. Drum can be trundled off when it's filled. Or a portable pump will pump the water from the drum to the outside while the vacuum cleaner keeps on working.

• **Public address and radio.** Remember the fire-truck driver back at the start of this article? He didn't even take his red phone off the cradle—he saw another man doing it. He counted on getting the word from his radio while he started up his truck, thus saving a few precious seconds.

Plant radio and red phones don't tell the whole story of in-plant emergency communications. There's also a public-address system to use when it's necessary to alert everybody about impending dangers, evacuation, and the like. Both the radio and the PA system operate off the plant electrical system. But if plant power goes out, gas-burning m-g sets (110-125 volts, a-c, 60 cycles) provide emergency power. Starting motors for the m-g sets are powered by 12-volt wet-cell batteries kept up to snuff by time-cycle trickle chargers. If plant power fails, these m-g sets cut in automatically. At the same time, circuit breakers automatically drop out and isolate the public address system from the dead-open or the dead-shorted plant power supply.

• **Location markings.** Columns throughout the plant are marked for quick identification. What's more, the roof is marked with numbers corresponding to the column numbers. This makes it easy for emergency crews to come in through the roof at just the right places. IBM-Kingston's manual of procedures includes a helpful diagram of the plant layout, complete with column (and roof) numbers and locations of emergency-equipment cabinets spotted around the plant.

• **Special alarm.** In the paint shop and the alcohol dip room an alarm bell rings locally if a fire extinguisher is turned on or removed from its position. **END**

Before you buy **any** battery

LOOK AT THE OTHER SIDE OF THE PRICE TAG!

The EDISON Nickel-Alkaline battery was created for those who will make a *higher initial investment* for a battery that will give many more years of trouble-free performance . . . and *will actually cost less in the long run.* Write Storage Battery Division, Thomas A. Edison Industries, West Orange, N. J. for booklet . . . or contact your local Edison representative. In Canada: CLM Industries, Division of McGraw-Edison Company (Canada) Ltd. Toronto 13, Ontario

U. S. PATENT 2,871,281

New active material gives Edison even longer life . . . even greater durability

WHY EDISON IS THE HIGHER-PRICED BATTERY THAT COSTS LESS

1. Longer life — lower depreciation
2. Reduces maintenance cost
3. Durable — no sudden failures
4. Full shift performance
5. Fully automatic charging
6. No corrosive fumes
7. Lowers cost of truck operation
8. Can stand idle indefinitely
9. Withstands temperature extremes
10. Other uses after heavy duty life
11. Lighter weight
12. Edison Nationwide Service

Another Product of McGRAW-EDISON

EDISON NICKEL-ALKALINE **STORAGE BATTERIES**

CUTTING... Panel Cutter zips through sheets up to 16-gauge. High visibility ahead of cutter edge makes it easy to follow straight or curved lines.

TRIMMING... Edging Chisel trims edges neatly and rapidly. There is no tendency to bend or distort the edge.

PUNCHING... Hole Punch makes perfect size holes for sheet metal screws, in a fraction of the time required for drilling. Extrudes metal at rear of sheet, which affords multiple thread grip for screw.

SAVES TIME...EASY TO USE!

NEW industrial CP-4XR Zip-Gun Kit is a versatile air-operated 9-tool outfit built to save time. It's easy to use and can help raise work quality in industrial plants and sheet metal shops. And five minutes after you try it on any erection job involving metal panels or ducts, the Zip-Gun becomes indispensable. Unskilled operators quickly learn to follow scribed patterns, trim sheets, punch holes for sheet metal screws.

REAL VERSATILITY FOR SHEET METAL WORK!

Shown at right are the 9 special accessory tools included in the CP-4XR Zip-Gun Kit. Gun and tools are packed in a sturdy metal carrying case, with a separate compartment for each tool. Weighs only 12½ pounds.

Cutting tools and punches are made of high grade electric furnace alloy tool steels. Safety, quick-releasing retainer holds them firmly in the Zip-Gun while in use . . . makes changes fast and easy.

sheet metal

save time . . . improve quality with the NEW CP-4XR (Air-Operated) ZIP-GUN

Chisel Blank

Flat Chisel

Panel Cutter

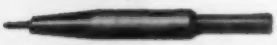
Edging Chisel

CP-4XR ZIP-GUN with Quick-Release Safety Retainer and Power Regulator. Weight: Only 3½ pounds.

New CP-4XR Zip-Gun Kit. Weighs only 12½ lbs.

Hole Punch for #6 Screws

Hole Punch for # 8 Screws



Hole Punch for #10 Screws

Hole Punch for #12 Screws

Hole Punch for #14 Screws

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS
DIESEL ENGINES • HYDRAULIC TOOLS • VACUUM PUMPS

Chicago Pneumatic Tool Company, Dept. Z-1
8 East 44th Street, New York 17, N. Y.

☐ Please arrange for no-obligation, in-the-shop demonstration of the new industrial Zip-Gun

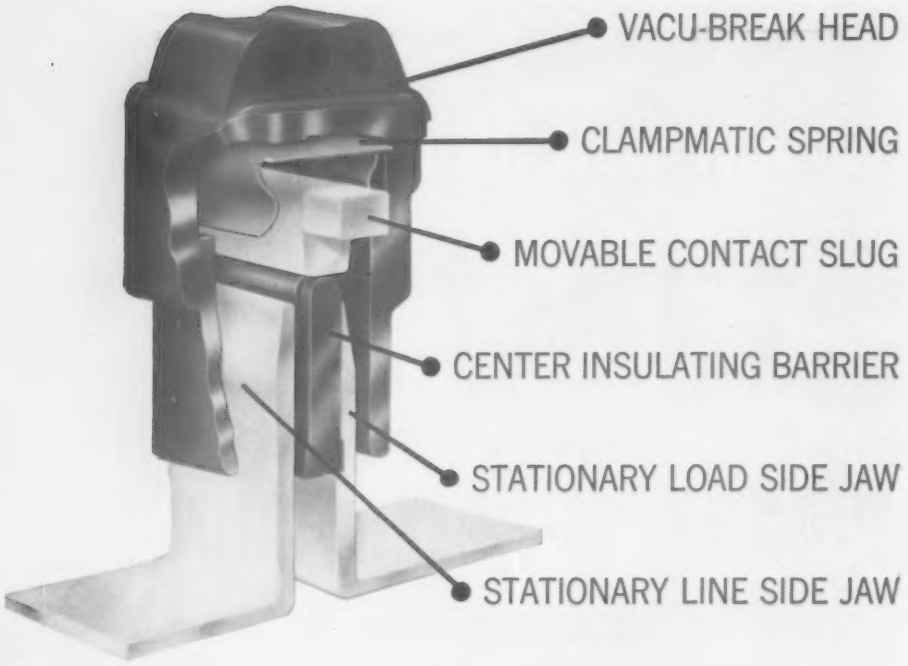
☐ Please send me FREE Bulletin, SP-3243-2 giving details of new CP-4XR Zip-Gun Kit

Name_____

Company_____

Address_____

City_____ Zone____ State_____



INCREASED SWITCH LIFE WITH CLAMPED PRESSURE CONTACT AND VACU-BREAK ARC CONTROL

You get longer switch life from BullDog safety switches, thanks to unique BullDog design. The high-tension Clampmatic® spring puts pressure where it belongs—on contact faces after the switch is "ON." This clamped pressure action assures good electrical contact for the life of the switch. It means the switch lasts longer, too, for there's no overheating to damage switch components. In switching "OFF," the pressure's removed before the "break" . . . providing true quick-break action.

Vacu-Break® design is another reason BullDog safety switches last longer. Switching contacts are completely enclosed in the Vacu-Break head. Arcs are restricted, starved of oxygen, cooled and smothered quickly. In addition, Vacu-Break *double*-breaks the circuit, effectively reducing the arc length and arcing time.

Vacu-Break arc control plus clamped pressure contacts add up to long switch life . . . and dependable, economical service for you. You'll find BullDog safety switches need little or no maintenance over years of heavy-duty use. See your BullDog products distributor.

FOR SAFETY'S SAKE—BUY VACU-BREAK!

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY
BOX 177 • DETROIT 32, MICHIGAN

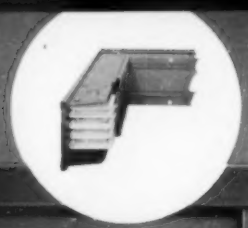
In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N.Y.

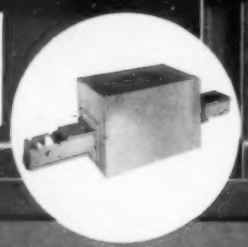
For more facts Circle 465 on Reader Service Card
For more facts on XL Busduct, Circle 466 on Reader Service Card ➤

IT'S HERE

NEW XL BUStribution® Duct

combines safety and ease of installation never available before!
Made by BullDog, the originators of Bus Duct systems.

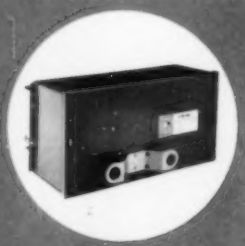




BULLDOG

gives you one source for fully-engineered components.

BullDog provides a complete line of fully-engineered components for use with new XL BUStribution Duct and Safety-Plug. You can get everything you need from a single convenient source—your local BullDog distributor.



IMPORTANT SPECIFICATIONS
of new XL BUStribution Duct

LOW VOLTAGE DROP . . .
as low as one-half that of other plug-in duct systems.

•

50,000 RMS SHORT-CIRCUIT RATING
in all sizes above 225 amps.

•

SINGLE-BOLT BAR CONNECTION
in all sizes up to 800 amps.
(800 to 1000 amps.—2 bolt connection)

•

FULL BUTYL INSULATION

•

TEN-FOOT SUPPORTING SPANS

•

COMPACT:
30% smaller, 25% lighter than other duct systems

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY
BOX 177 • DETROIT 32, MICHIGAN

FORM NO. XL-1

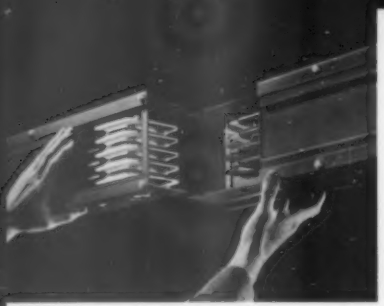
LITHO IN U.S.A.

AND HERE'S
THE NEW
MATCHING **XL**

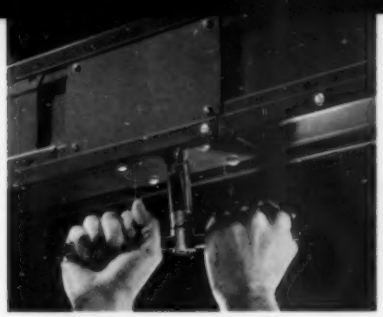
SAFETY-PLUG

that makes plugging in fast and safe!

The new XL SAFETY-PLUG lets you plug into XL BUS-tribution Duct in seconds with complete safety! New design provides safety features *not* found on any other plug. Plugs are available which prevent installation or removal when plug handle is in the "on" position. You *can* plug in from either side of the duct, in all duct sizes from 225 through 1000 amps. You *can* use all plug-in openings at the same time if desired.



1. FAST INSTALLATION. Keyed bus ends align themselves positively, instantly, without fumbling or wasted time. You can position sections as fast as you can handle them!



2. EASY INSTALLATION. This one integral bolt locks POSITIVELY . . . holds keyed bus ends under a ton of pressure. The fully insulated bolt spins tight fast. Joints stay locked!

3. ECONOMICAL INSTALLATION. You need only half as many hangers as usual. Ten-foot supporting spans cut number of hangers and the time needed to install them by 50%.

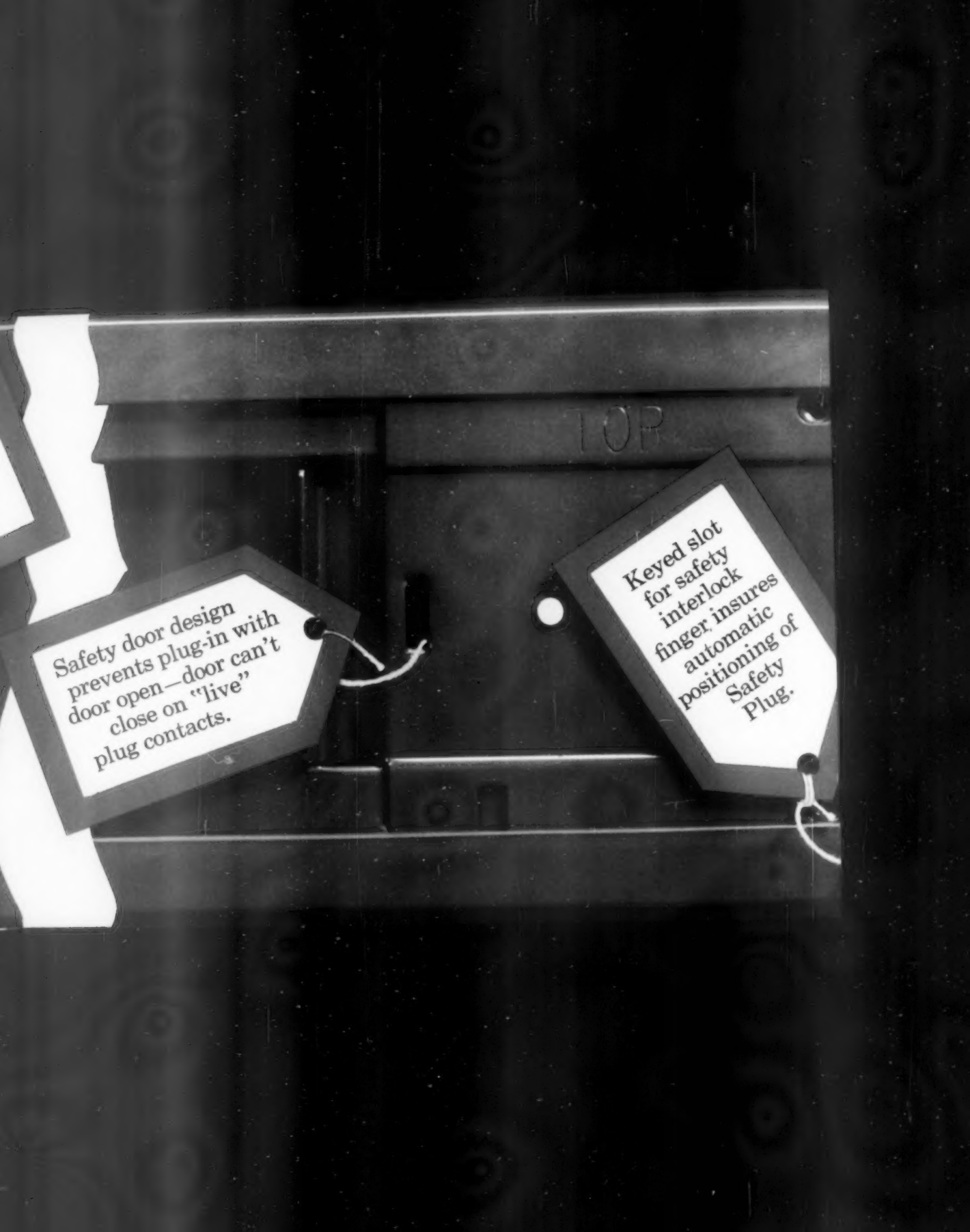
HERE'S WHY XL BUStribution Duct is best for you

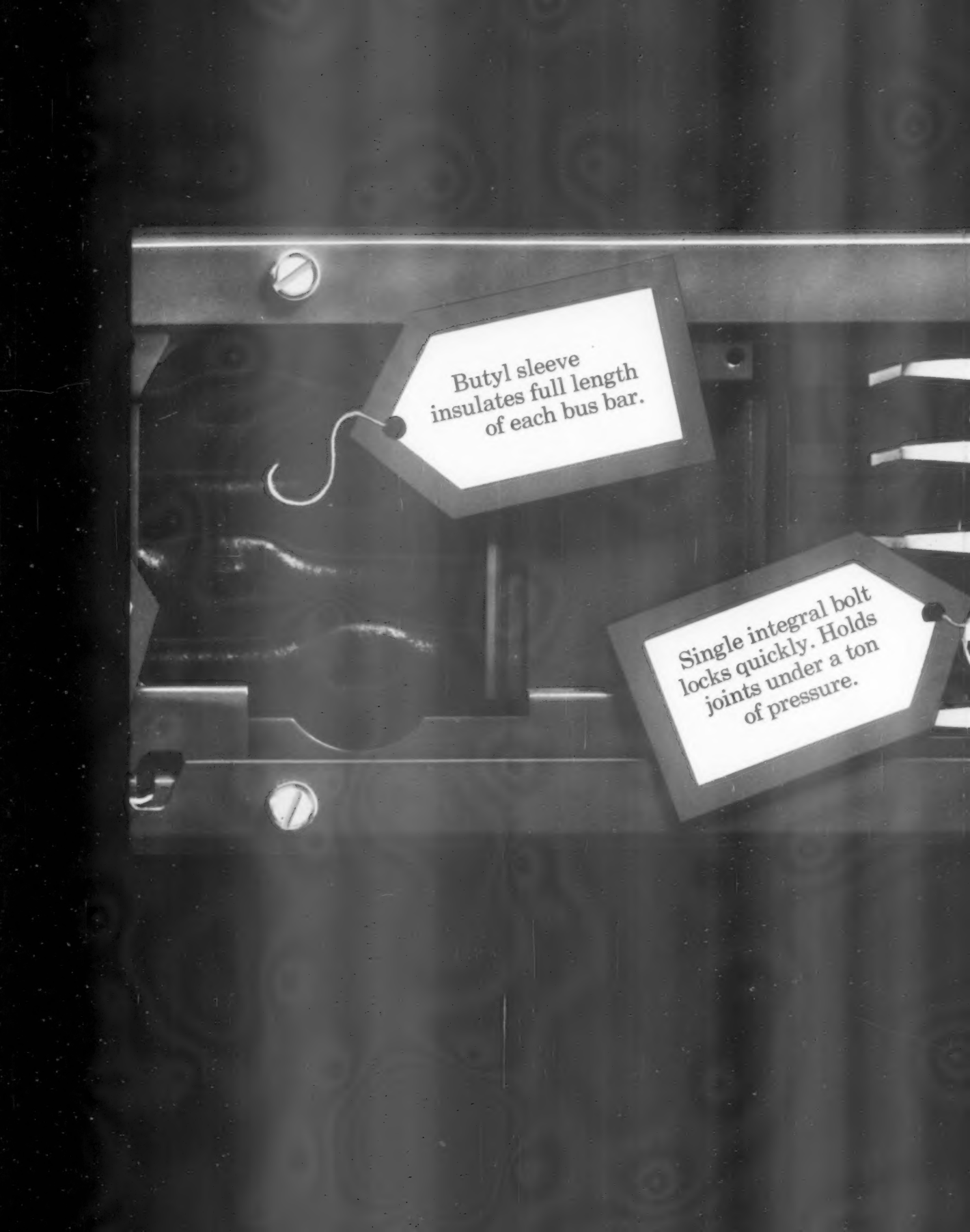
4. DEAD-FRONT SAFETY. Each bus bar has full-length Butyl insulation, even in bus plug openings. XL BUStribution Duct is the world's safest duct to plug into, to work around.

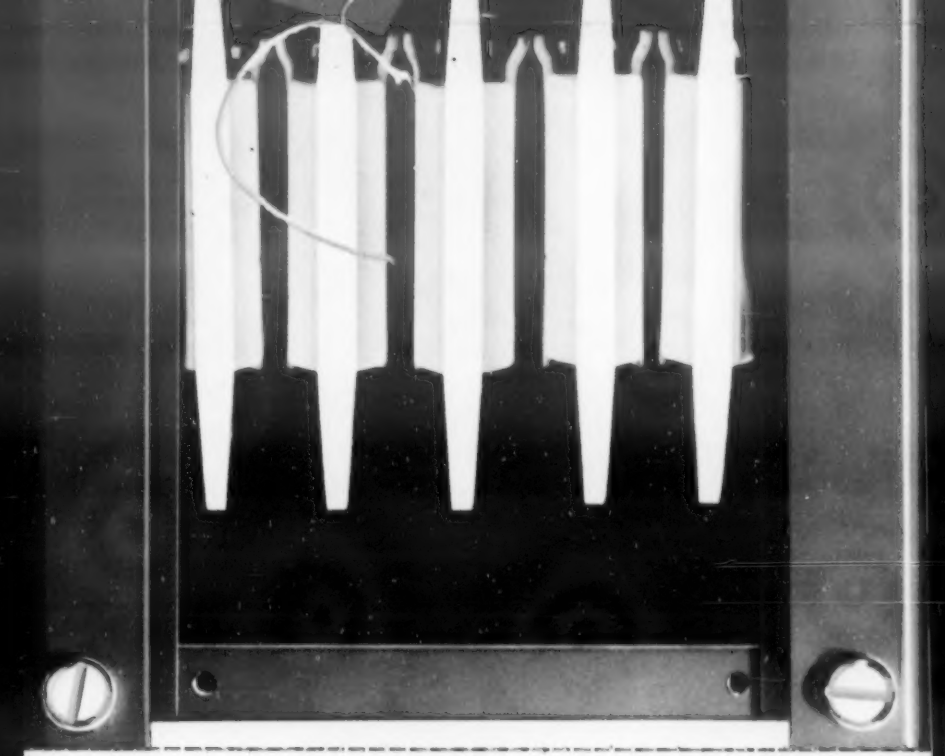
5. PERSONNEL SAFETY. Safety door covers the opening . . . slides back when safety interlock finger is in position. Plug cannot be removed or installed when safety door is open.

6. EQUIPMENT SAFETY. SAFETY PLUGS cannot be installed or removed when in the "on" position . . . exclusive design positively protects against arcing, safeguards equipment.

Keyed bus ends
provide instant,
proper assembly every
time—make duct
installation fast.


TOP
Safety door design prevents plug-in with door open—door can't close on "live" plug contacts.
Keyed slot for safety interlock finger insures automatic positioning of Safety Plug.


Butyl sleeve
insulates full length
of each bus bar.
Single integral bolt
locks quickly. Holds
joints under a ton
of pressure.



FOR MORE INFORMATION, USE THIS COUPON

BullDog Electric Products Division
I-T-E Circuit Breaker Company
Box 177, Detroit 32, Michigan

Please send me detailed information on the new BullDog XL BUSTRIBUTION® DUCT.

NAME_____ **TITLE**_____

COMPANY_____

ADDRESS_____

CITY_____ **ZONE**____ **STATE**_____

FACTORY CATALOG NEWS

For more about these items, circle numbers on Reader Service Card next to back cover.

MAINTENANCE

1—Heat Warners. Here's a 4-pager that tells about a warning system that detects overheating before damage is done to machinery, equipment, or property. Device releases distinct odor or dense, white smoke. *Humphrey-Wilkinson, Inc.*

2—Conveyor Lubricator. Purpose, design, operation, and advantages of these automatic lubricators are covered in No. CL659 (8 pages). Describes fundamental improvements of models in two of maker's series. *J. N. Fauver Co., Inc.*

3—Hazard Warning Lights. Catalog No. 55 discusses flashers, torches, lanterns. Tells, in 12 pages, when and how to use these warning lights; gives battery details, sizes, etc. *R. E. Dietz Co.*

4—Fire Equipment. This 20-pager (Form F5975) describes hand portable extinguishers, stationary fire equipment and piped systems. Lists types, capacities, and classifications. *Ansul Chemical Co.*

5—Work Gloves. Bulletin 1315-1 (4 pages) shows the latest glove styles in neoprene, natural rubber, vinyl plastic, with linings of jersey, canton flannel, interlock fabric. Gives applications for each style. *Mine Safety Appliance Co.*

MECHANICAL

6—Hydraulic Cylinders. Features and performance data on new high-pressure cylinders are described and illustrated in easy-to-use Catalog-Engineering Guide 117 (12 pages). In 12 bore sizes from 1⅛ to 12 in. *The S-P Mfg. Corp.*

7—Couplings. Catalog No. 60 is a revised version of Nos. 51 and 51-A covering couplings and their installation. Includes facts about dynamic balancing, bore and keyway standards, applications. *The Thomas Flexible Coupling Co.*

8—Still-Seal Gaskets. This 8-page brochure tells all about custom-designed rubber-to-metal bonded gaskets for static sealing applications. Information on seal configurations, dimensions, selection tables. *Stillman Rubber Co.*

9—Gear-Belt Drives. Here's a 58-page catalog (GB-201-A) with information and illustrations for three basic kinds of pulleys—miniature bore, fixed bore, and bushed type that uses malleable split taper bushings. *Browning Mfg. Co.*

10—Variable Speed Sheave. Construction and installation data for new stationary control sheave for standard V-belts are contained in 8-pager (6102). The positive locking sheave comes with 2, 3, or 4 grooves. *T. B. Wood's Sons Co.*

11—Brakes. Bulletin EE-220 (16 pages) describes five new solenoid-operated brakes, available in sizes from 2½- to 14-in. wheels. These brakes (the Theta series) have many applications. Dimension data, etc. *Trombetta Solenoid Corp.*

VALVES AND FITTINGS

12—Valves, Fittings. Information on line, globe, relief, check valves, heat exchangers, flare fittings and related brass products is given in Catalog R-7 (20 pages). Sizing, applications, other data. *Superior Valve & Fittings Co.*

13—Butterfly Valve. Bulletin 10DS has over 26 pages covering maker's new Monoflange Mark 11 rubber seat butterfly valve. Includes specifications, dimensional drawings, water and gas flow data, weights. *Henry Pratt Co., Inc.*

14—Air Control Valves. Specifications and performance details are contained in 12-page catalog (No. 592). Valves are 1-in. thick, 1½-in. wide, and come in six valve actions. Has cutaway view, dimensional drawings. *Hunt Valve Co.*

15—Flex Joints, Bellows. Here's a 4-pager (SB-1) that describes molded Fluoroflex-T joints and bellows made from Teflon for non-standard low- and high-temperature and corrosive applications. Pressures, test data. *Resistoflex Corp.*

16—Single Control Valve. Bulletin WC-122 (4 pages) discusses Monotrol valve for controlling flow of liquid in zeolite softeners, ion exchange units, filters. Operates manually or automatically. *Graver Water Conditioning Co.*

17—Butterfly Valves. This 36-pager (5904) describes iron body, rubber-seated valves for hydrostatic operating pressures to 125 psi. Explains applications. Gives photos. *Darling Valve & Mfg. Co.*

ELECTRICAL

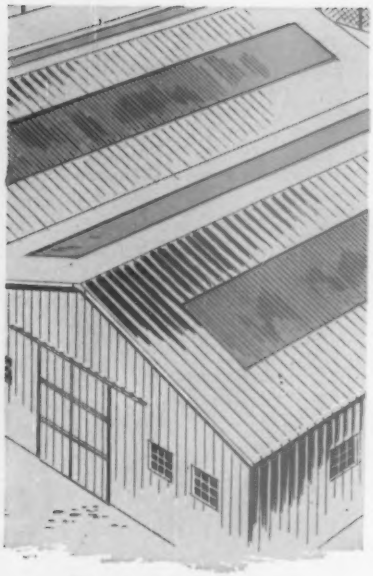
18—Frequency Meters. Ranges, sizes, designs of standard and precision resonant reed meters are covered in 20-pager (No. 32). Meters come in miniature, switchboard, and portable types in ranges from 10 to 1700 cps. *James G. Biddle Co.*

19—Circuit Breakers. Bulletin 5001-1A (40 pages) describes molded case circuit breakers ranging from smallest, for lighting circuit protection, to special-purpose models. Chart gives data for each breaker. *I-T-E Circuit Breaker Co.*

20—Protective Devices. Here's a Protection Handbook that contains suggestions for selecting correct devices for electric circuits, motor appliances and apparatus. Code references cover various problems. Diagrams. *Bussmann Mfg. Co.*

21—Electric Power Drives. Catalog No. 258 has 68 pages of information on squirrel cage motors, gearmotors, speed reducers, variable speed drives. Includes over 8000 ratings; other technical data. *Sterling Electric Motors Inc.*

Turn the page



Bring free daylight in with

NEW

Stylux BY BUTLER

- Best plastic panels you can buy! Longer life; up to 90% light transmission from new weather-tested resin bonded to superior quality fiberglass mat.
- Wider, money-saving widths—new 4-ft. coverage size saves installation costs. Also standard panel and pane sizes. Ideal for partitioning, inside and out improvements.

Use new Stylux and save replacement costs over all other panels. Shatterproof, noncorrosive. Guaranteed uniform quality. Get literature, specs from your Building Supply Dealer, Glazing Contractor or write us direct.

Stylux BY BUTLER

Plastics Department,
Buildings Division
BUTLER
MANUFACTURING
COMPANY
Dept. 110, 7400 East 13th Street
Kansas City 26, Missouri

For more about these items, circle numbers on Reader Service Card next to back cover.

22—Lighting Equipment. "When lights go out . . . Light Warden goes on," according to Catalog LW-1, an 8-pager. It describes system that instantly provides illumination when regular power supply is exhausted. *Electric Cord Co.*

23—Multi-Outlet Baseboard. Here's a 4-page folder (No. 606) that describes all-steel baseboard, devices, and fittings. Gives details of methods of fastening Plugmold 2200 to various surfaces. Also covers installation. *The Wiremold Co.*

24—Battery Chargers. Selection and use of specific models of constant-voltage, silicon rectifier chargers for stationary type batteries are set forth in folder of eight technical data sheets. Diagrams, photos. *The Electric Storage Battery Co.*

25—Motor Starters. This 72-pager (GEC-1260D) describes and illustrates manual and magnetic starters, contactors, relays, solenoids, limit switches, and the like. Selection charts list motors of ¼ to 200 hp. *General Electric Co.*

26—Motor Controls. Manual starters, magnetic controls, drum controllers, pilot devices, other products and accessories are discussed in 72-page illustrated catalog (No. 5900). "Quick Selector" chart gives hp., speeds, sizes, other data. *Furnas Electric Co.*

BUILDING

27—Railings. Here's a 4-page catalog that's a specification guide for stair rails, safety rails, etc. Includes standard finishes, sizes, and diagrams. Shows concrete-filled columns of various shapes and types. *Tubular Products, Inc.*

28—Steel Decks and Doors. Two 16-pagers: No. D-60 gives details about roof-deck section that's said to speed installation work about 50%. No. G-60 describes 14 types of rolling steel doors, grilles, shutters. *R. C. Mahon Co.*

29—Thermal Insulation. Bulletin I-10, a 4-pager, contains data on insulation for metal, masonry buildings, and equipment. Includes coefficients of heat transmission for walls and roofs. *Columbia Acoustics & Fireproofing Co.*

30—Skylight Products. Skylights of fibrous glass reinforced translucent structural panels with extruded aluminum frames are shown in 4-pager (AIA. File No. 12-j). Describes models for curbs and roofs that are not level. *The Marco Co.*

31—Movable Partitions. This 8-page reference guide (No. 460) covers partitions rail-high to ceiling height. Finishes include four pastel colors and four wood-grain surfaces. Details of "workable wall" and fixtures. *L. A. Darling Co.*

MATERIAL HANDLING

32—Conductor Systems. Bulletin 2016 (4 pages) describes systems for safe electrification on overhead material-handling equipment. Features include double insulation, continuous electrical contact, others. *Cleveland Crane & Engineering Co.*

33—Suspension Scale. Have you a weighing problem in your plant? This 8-pager (No. 58E) discusses hook scales for checking loads, taking weight inventories as materials are lifted, other uses. Hook and eye data. *W. C. Dillon & Co., Inc.*

34—Hoists. Catalog R (12 pages) describes product for overhead handling of loads from ¼ through 60 tons. Provides data on more than 20 kinds of cranes, hoists, specialty and accessory items. Photos, diagrams. *The Harrington Co.*

35—Coolers and Dryers. Here's a 32-pager (No. 953) that covers direct and indirect electric and mechanical vibrating-type coolers and dryers, other equipment. Explains basic drying principles. Charts, photos. *The Jeffrey Mfg. Co.*

Turn the page

Just 24 minutes with this movie can save hundreds of man-hours in your plant

If you're concerned with cost control, don't miss Texaco's movie about grease, called "Shear Magic."

There's no hard sell in "Shear Magic." It's devoted entirely to helpful information on ways to cut the cost of maintenance and prevent unscheduled downtime.

A well-planned grease schedule can extend equipment life and cut repair costs and you can bring this message home to your maintenance men by having them see "Shear Magic." This movie suggests ideas for planning the grease schedule that best fits your operation. And it reminds the men that properly choosing and applying greases helps their company, because it assures tighter control of maintenance costs.

A Texaco Lubrication Engineer will be glad to arrange a showing of this full-color film in your plant. Or, if you wish, send for the informative Texaco booklet called *A Grease Schedule for Cost Control*. For quick action, mail the coupon today.

TEXACO

Texaco Inc.
Dept. F-G-30
135 East 42nd Street
New York 17, N. Y.

☐ Please send me more information about a free showing of "Shear Magic" to my organization.

☐ Please send me a copy of *A Grease Schedule for Cost Control.*

Name_____

Company_____

Address_____

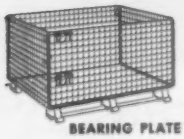
City_____ State_____

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

THE
RIGHT
ANSWER
FOR LARGE PLANTS
OR SMALL

Another typical example of how Palletainers conserve floor space in busy produce warehouse.

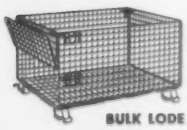
USP PALLETAINERS



BEARING PLATE

HI LODE

WAREHOUSE



BULK LODE

Why pay a premium for wasted floor space when you can make it do double triple duty by simply storing, stacking or transporting your products or materials in USP Palletainers.

Palletainers are available in a wide range of sizes, types and styles to meet your needs. Engineered to handle light and fragile products, or heavy unit loads up to 6000 pounds each with perfect safety and full inventory visibility. They'll stack to the rafters and cut your shipping losses, too. And...when empty, they can be folded flat for space saving and lower return freight rates.

No matter what you manufacture—store or transport—in a large plant or small... You need Palletainers!

You can see for yourself how USP Palletainers will quickly pay for themselves in your plant. Ask for your own copy of the big, new Palletainer catalog today. It's profusely illustrated with interesting, money saving applications plus complete specifications and construction details.

USP
UNION STEEL
PRODUCTS CO.
ALBION, MICHIGAN

FACTORY / CATALOG NEWS

Begins on page 185

For more about these items, circle item numbers on Reader Service Card next to back cover.

36—Trucks. Advantages of trucks for specific material-handling problems are described in 4-pager. Discusses underslung trailer for drums, barrels, other heavy units; heavy-duty die truck; utilities racks on wheels. *Palmer-Shile Co.*

37—Racks, Rack Sections. This illustrated 8-page bulletin presents new racks that assemble independently of pallets. Two tubular steel frames snap together to form racks—no bolts, screws, or fixtures needed. *Tier-Rack Corp.*

38—Trucks. Catalog J-1 has 24 pages that contain specifications for platform trucks, two-wheel trucks, skids, casters, trailers. Includes easy-to-use "job-suited" system. *Thomas Truck & Caster Co.*

AUXILIARY

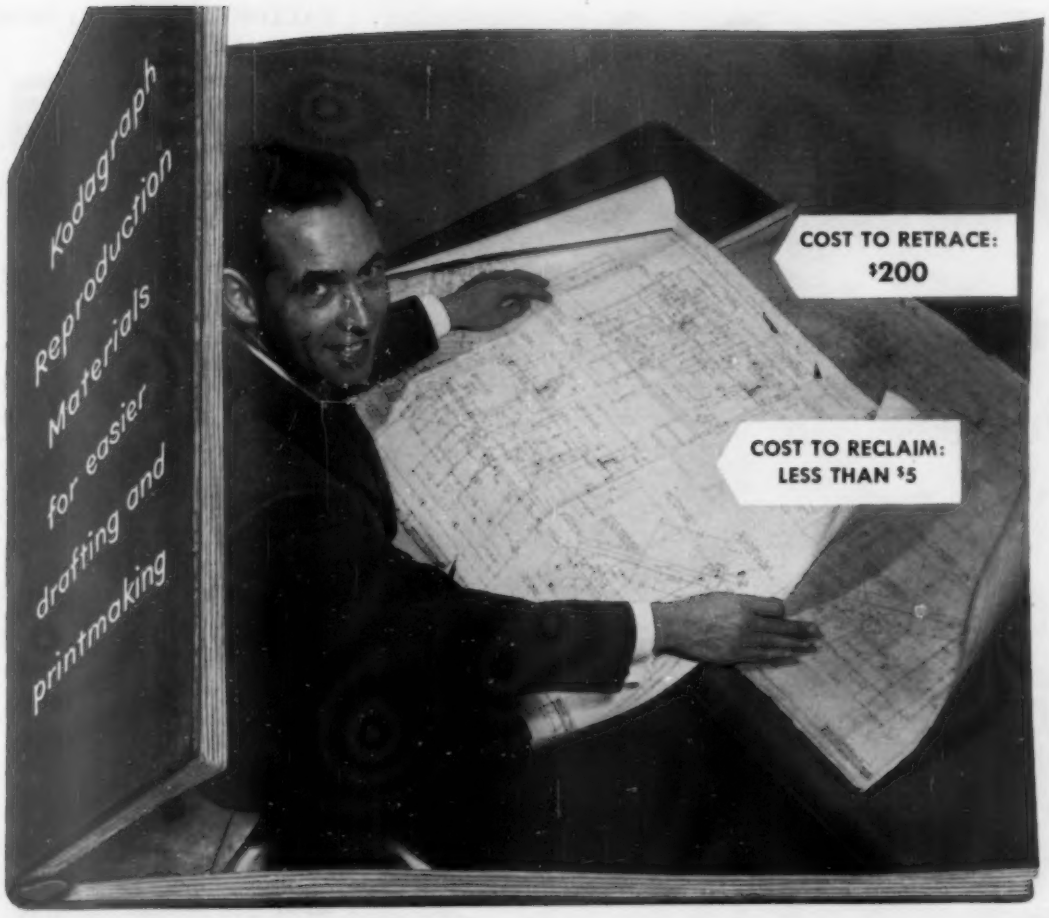
39—Automatic Firing Equipment. Catalog No. 6260 (12 pages) discusses gas, oil, and coal equipment for heating, processing, and power. Includes basic data on comparison of costs between different fuels. *Iron Fireman Mfg. Co.*

40—Compressors. Bulletin No. 91 (8 pages) describes construction and operating features of two types of packaged compressors for gas gathering—includes details on two- and four-throw models. 100 hp. up. *Cooper Bessemer Corp.*

41—Automatic Boilers. Data on 35 models of "package" boilers, sizes 15-600 hp., are given in BE-400 (8 pages). Specifications for boiler and integral burner systems for oil, gas, combination fuels. *Boiler Engineering & Supply Co.*

42—Gas-Fired Unit Heaters. Advantages of unit heating and description of heaters that operate on natural, manufactured mixed, LP, and dual-fuel gases, are set forth in 16-pager (Form JS-151P). Photos. *Surface Combustion Corp.*

Turn the page



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Saved: $195 in Redrafting costs by making a Kodagraph Autopositive Paper intermediate

BEFORE you retrace another soiled or weak line drawing ask your print room or local blueprinter to figure the cost of making a Kodagraph Autopositive Paper intermediate.

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Both management and employees have a lot to gain from the mild Santa Clara County climate. Productivity goes up as your COMFORT INDEX approaches the ideal level. But you get *more* than exceptional livability. This unique location at the Southern tip of San Francisco Bay places Santa Clara County right in the *market and transportation center* of the West.

First, compare the COMFORT INDEX of each potential industrial site. When you add the other advantages, every fact points to SANTA CLARA COUNTY – for maximum *livability* and *productivity*.

*COMFORT INDEX—One of many terms used to describe the exact point at which the climate of a particular area approaches an ideal combination of moderate temperature, low humidity.

SEND TODAY for these two booklets and bring your plant site research file up to date: "What Do You Mean – COMFORT INDEX?" and "NEW INDUSTRY SPEAKS".

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SANTA CLARA COUNTY · California

FACTORY / CATALOG NEWS

Begins on page 185

For more about these items, circle item numbers on Reader Service Card next to back cover.

43—Air Distribution Equipment. Here's an 8-page catalog (F-4471-6) that highlights Uni-Flo sidewall, ceiling and floor diffusers, high velocity equipment, and accessories. Specifications, photos, diagrams. *Barber-Colman Co.*

44—Heat Exchangers, Steam Jets. This 12-page bulletin (S-6620) discusses graphite immersion heat exchangers and circulating steam jets for heating or cooling corrosive solutions in tanks. Diagrams, data curves. *National Carbon Co.*

45—Metering Pumps. Information about positive-displacement, plunger-type pumps is given in 12-pager (420.200). Pumps are electrically driven, capacities from 0.65 to 2025 gph. Data on accuracy, etc. *Wallace & Tiernan Inc.*

INSTRUMENTS AND CONTROLS

46—Digital Instrumentation. Here's a useful folder that contains 25 bulletins to illustrate the systems possible with maker's digital equipment. Information includes forms of instrumentation and their advantages. *Datex Corp.*

47—Electronic Instruments. Electrometers, micro-microammeters, other instruments and accessories are described and illustrated in this 1960 catalog (32 pages). Schematic diagrams and application circuits. *Keithley Instruments, Inc.*

48—Process Timers. Bulletin GEZ-2985 (4 pages) tells about timers for controlling repeating cycles. Applications from control of processes to sign flashing. Gives ratings, etc., for adjustable "on" time units. *General Electric Co.*

49—Predetermining Counters. Mechanical, electromagnetic, and photoelectric counters are described and illustrated in 4-page folder (Form 227773). Tells how operator can

U. S. ROYAL V-BELTS from the Power Unlimited complete belt line

Exclusive new process gives

balanced driving power

Now you can give your equipment the kind of driving power that comes only from V-belts that are as close-to-perfect as the world's most advanced manufacturing methods can make them. Specially developed equipment automatically controls thickness, weight, density, length, and tension members so precisely that each U. S. Royal gives you *balanced* driving power that pays off in every aspect of a belt's performance.

Smoother running. Variations inherent in other belts lead to vibration, intermittent slippage, increased bearing wear, excessive heat build-up, and early belt failure. Because of the "balanced driving power" resulting from exclusive manufacturing processes, U. S. Royals are the sweetest running belts in the business.

Unequaled length stability. Test after test has demonstrated that each U. S. Royal V-Belt with balanced driving power is a perfect working match for the others in its set. And every U. S. Royal V-Belt on a multiple drive will *continue* to pull its share of the load long after other "matched" belts have begun to assert their individuality.

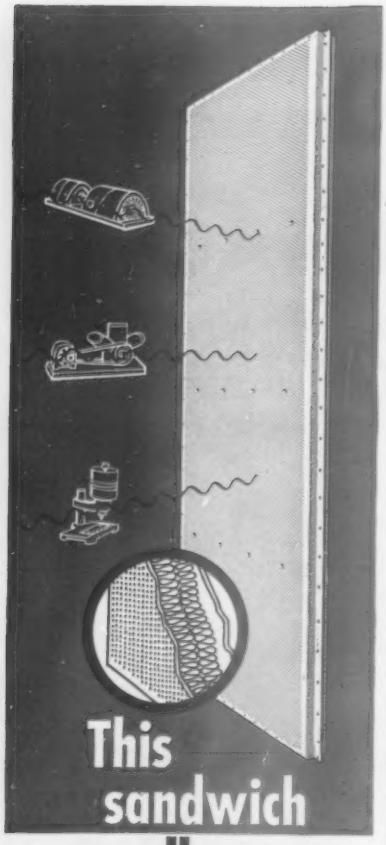
No weak spots. Because there are no "weak links," you get longer lasting driving power and greater freedom from maintenance than ever before. Take advantage of the balanced driving power only U. S. Royal V-Belts offer. Your "U. S." Power Transmission Distributor has full stocks to service you promptly.

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.



This sandwich swallows noise

This is an Eckoustic Panel — a very special sandwich, made of two layers of steel wrapped around a blanket of Fiberglas.

You can use it as a modular building block to build a soundproof room or plant office — a machinery enclosure — a production test facility — or, for that matter, practically anything where you must shut noise out, or seal it in.

Eckoustic panels protect employees from the harmful effects of exposure to continual noise . . . increase employee efficiency by creating more comfortable working conditions. And we have the results of acoustical studies which show they do it more effectively than other types of acoustical panels.

We also have a free folder that tells how Eckoustic Panels can help you solve sound control problems faster and more economically than you may have thought possible.

Let us send you the complete information without obligation.

Write:

THE Eckel CORPORATION

155 Fawcett Street, Cambridge 38, Mass.

FACTORY / CATALOG NEWS

Begins on page 185

For more about these items, circle item numbers on Reader Service Card next to back cover.

preselect desired number of pieces, turns, strokes, lengths, or other units. *Veeder-Root Inc.*

50—Data Collecting System. Here's a 20-page technical manual (SP-8680R) that discusses the Collectadata, a system of readers and punches that collect data from several points of origin to the central processing point. *Friden, Inc.*

51—Recorder/Reproducer. Bulletin 1618 (4 pages) covers operating characteristics and specifications for two units: a digital tape recorder/reproducer transport, and a high-speed transport. *Consolidated Electrodynamics Corp.*

52—Control Systems. "Industrial Temperature Measurement and Control" is a 23-pager (No. 101) that tells how to save money by eliminating guesswork in measuring process temperatures. Covers nine basic controls. *Partlow Corp.*

PRODUCTION

53—Bore-Matics, Grinders. Catalog 1-2 (16 pages) describes design features of maker's machines, including internal and rotary surface grinders, tool sharpeners, boringheads, wheelheads, attachments. Photos. *Heald Machine Co.*

54—Verti-Slide Machine. Operating data and specifications for vertical four-slide machine are given in 6-page bulletin. Describes such components as cam timing disk, center form, slide feed assembly. *The Torrington Mfg. Co.*

55—Metal Machining. This manual (116 pages) gives basic information on machining and selection of cutting fluids. Covers machineability of material, tools, functions of cutting fluids. *Gulf Oil Co.*

56—Welding Fittings. Here's a technical bulletin (FDC-274) that's one of 24 giving sizes, dimensional and physical data for fittings and forged

ENGINEERED for DEPENDABILITY,

DARNELL CASTERS & WHEELS

offer long range economy

A TYPE AND SIZE FOR EVERY PURPOSE

for added efficiency . . .

extra economy

RUBBER TREADS . . . a wide choice of treads suited to all types of floors, including Darnelloprene oil, water and chemical-resistant treads, make Darnell Casters and Wheels highly adapted to rough usage.

RUST-PROOFED . . . by zinc plating, Darnell Casters give longer, care-free life wherever water, steam and corroding chemicals are freely used.

LUBRICATION . . . all swivel and wheel bearings are factory packed with a high quality grease that "stands up" under attack by heat and water. Quick grease-gun lubrication provides easy maintenance.

STRING GUARDS . . . Even though string and ravelings may wind around the hub, these string guards insure easy rolling at all times.

FREE MANUAL

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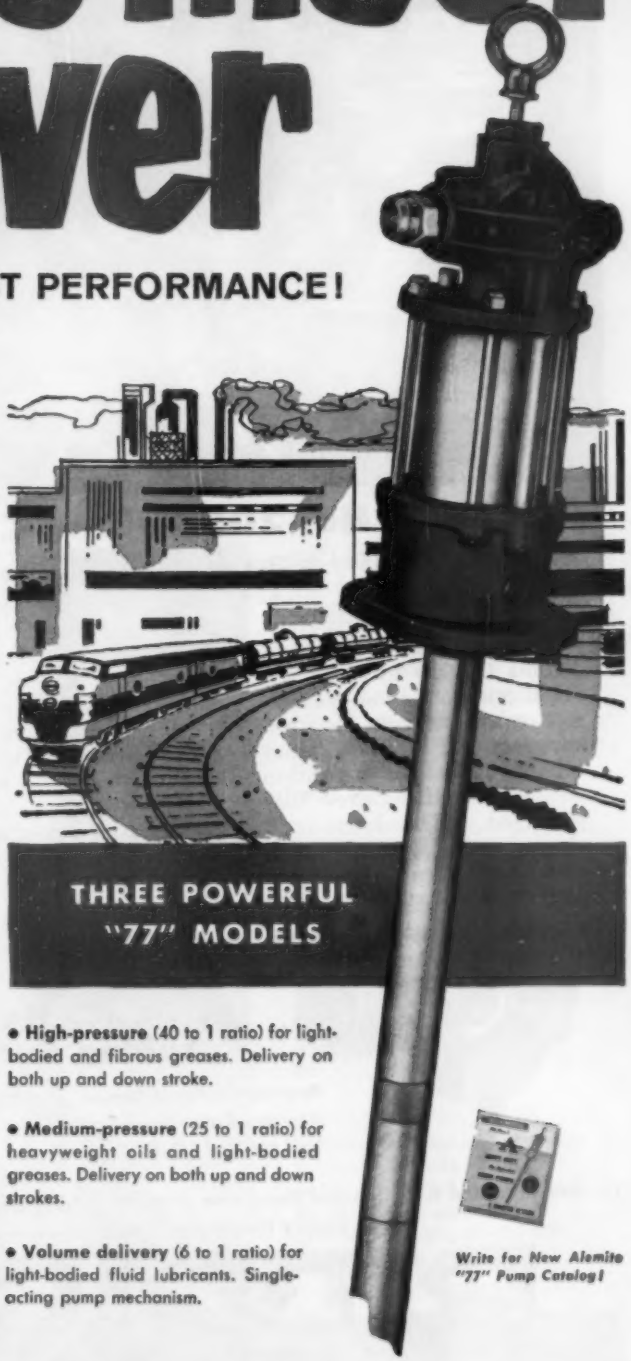
ALL-NEW ALEMITE "77" LUBRICANT PUMP

packs most power

FOR HIGHEST PERFORMANCE!



68% More Powerful . . . outperforms any other air-operated lubricant pump of its class on the market today! The all-new 5.2 horsepower Alemite "77" Pump assures smoothest, fastest delivery of all lubricants, through longest lines!

Three Master Pressure Ratios for unequalled delivery of all lubricants – fluid, semi-solid and heavy fibrous types. Lightweight, rust-proof aluminum construction.

Precision Engineered from finest quality materials–designed for outstanding ease of operation and maximum performance. Models for 120-lb. or 400-lb. drums – for all industrial applications.

All-New Alemite "77" Features!

• **Volume Air Distributing Valve**–self-seating, self-cleaning, volume porting • **Modern-Design, Highly Efficient Toggle Trip Mechanism** provides balanced pressure on shuttle . . . won't bind • **Straight-Line Exhaust** has extra-large port for highest pump efficiency • **Hardened Steel Piston and Cylinder,** lapped to a precision fit of 125 millionths of an inch • **All-Steel Primer Valve,** ground to a perfect seal . . . hardened for abrasion resistance • **Dynamic Primer** assures priming and pumping of heaviest lubricants.

THREE POWERFUL "77" MODELS

• **High-pressure** (40 to 1 ratio) for light-bodied and fibrous greases. Delivery on both up and down stroke.

• **Medium-pressure** (25 to 1 ratio) for heavyweight oils and light-bodied greases. Delivery on both up and down strokes.

• **Volume delivery** (6 to 1 ratio) for light-bodied fluid lubricants. Single-acting pump mechanism.

Write for New Alemite "77" Pump Catalog!

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2 New
RIDGID
Tubing Cutters
Give you Grooved Rollers for close flare cut-offs... no waste! Also, Enclosed Feed Mechanism • Spare Cutter Wheel in Handle •
Fold-in Reamer

RIDGID No. 205 Tubing Cutter

Time-Saving, Slide-to-Size ⅛" to 2⅜" O.D. Capacity

Made of lightweight, high-strength cast aluminum alloy, you'll find these new RIDGID Tubing Cutters extra handy. Slight push on handle of large-size-range RIDGID No. 205 snugs cutter wheel against tubing . . . locks it in position until released. Feed screw fully protected and enclosed . . . always feeds into tube with easy handle turn . . . can't jam with chips or dirt. Wheel gives quick, clean cuts of copper, brass, aluminum tubing and thin-wall conduit . . . no burr. Grooved rollers give easy flare cut-offs without tubing waste. Tubing always turns freely on 2 of 4 Rollers. Rollers smooth tubing ready for soldering. Fold-in reamer always handy. Spare cutter wheel in handle. Wheel for plastic and aluminum pipe available for No. 205 only.

Conform to Fed. Spec. GGG-C-771b Type II—Class I—enclosed feed mechanism

RIDGID No. 105 Tubing Cutter

Protected Feed Screw
Always Easy-Turning
⅛" to 1⅛" O.D. Capacity

To save time and tubing, order these new RIDGID Tubing Cutters today!
Your Supply House has them!

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.

FACTORY / CATALOG NEWS

Begins on page 185

For more about these items, circle item numbers on Reader Service Card next to back cover.

steel flanges. Lists tubular products, seamless and welded, and extrusions. *Babcock & Wilcox Co.*

57—Flame-Cutting Machine. The Linagraph automatic machine is the subject of Catalog 804-L (8 pages). Explains its principal features—centralized operator control, pantograph design, and adaptability. *Air Reduction Sales Co.*

58—Shear Knives. Six grades of metal-cutting knives and their specific uses are described in illustrated brochure. Other equipment includes rotary slitter knives, tinning machine, galvanizing rolls, dies. *American Shear Knife Co.*

59—Induction Heating. This 6-pager (DM-117) discusses use of portable 400-cycle induction heating equipment for stress-relieving welded joints. Explains principles. Photos. *Hobart Brothers Co.*

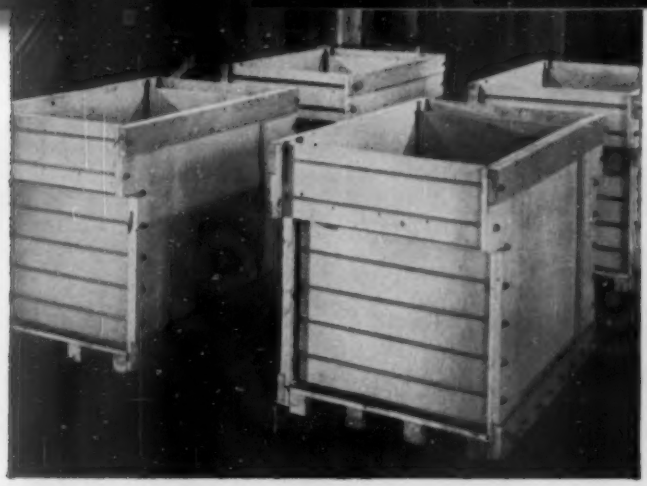
60—Machine Shop Accessories. Arbors, adapters, collets, and other accessories are shown in 48-page Catalog 37A. Easy-to-read list of features of products and characteristics of materials. Illustrated index. *Brown & Sharpe Mfg. Co.*

61—Punching, Notching Units. Catalog B has 16 pages of information on Series B hole punching and corner, vee and edge notching units. These have 5½-in. shut height and $2\frac{19}{32}$-in. die height. Photos, diagrams. *Punch Products Corp.*

62—Press Brakes. Design and construction data are given in 28-pager (No. 89E). These 90 to 150-ton-capacity brakes have welded one-piece frames. Illustrates dies and examples of applications. *Niagara Machine & Tool Works.*

63—Thread and Form Grinders. Catalog TFG-11-59 is a 12-pager that covers machines for production and toolroom thread and form grinding. Model 101 takes part length up to 12 in.; 103 handles pieces up to 24 in. *Sheffield Corp.*

For more facts Circle 476 on Reader Service Card
For more facts Circle 477 on Reader Service Card ➤



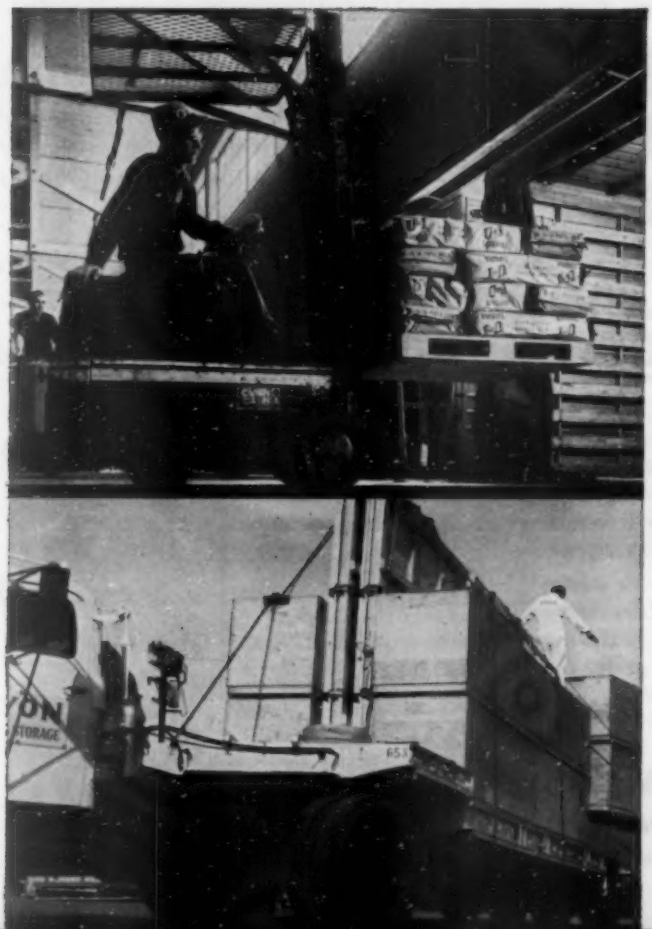
TANKS OF GPX are easily constructed, do not leak or corrode. Resistant to hydrocarbon, salt, soap, hydrochloric and sulphuric solutions, organic solvents, many others.

GPX® overlaid plywood solves your special problems!

Armor-hard high density overlay is fused to high-grade exterior plywood.

Tough **Georgia-Pacific GPX**

resists abrasion, chemicals, extreme temperatures, surface checking.



PALLETS, bins, chutes wear longer when made of GPX! Up to 30 times the abrasion resistance of unprotected plywood!

RE-USABLE CRATES of GPX for critical storage or handling. The smooth, tough, resin face protects against moisture, extreme temperatures, corrosives and contamination. Dimensionally stable. Requires no painting.

Standard thicknesses and panel sizes. Special sizes on order. Call your local G-P source or write for sample and specifications to Georgia-Pacific, Dept. F-260, Equitable Bldg., Portland, Ore.

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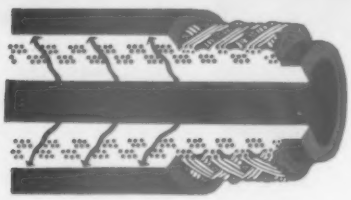


"MORE USE PER DOLLAR"

Rubber tie-gum penetrates Homoflex braided plies to provide an inseparable tube-to-cover bond . . . greater flexibility and lighter weight than any hose for equal pressure.

R/M HOMOFLEX HOSE HANDLES EASIER . . . LASTS LONGER

Homoflex Hose is mandrel-made with *no* pre-set twist—it coils and uncoils freely in *any* direction *without* kinking! It's the easiest handling hose made, in types for air, water, other fluids and gases. Exclusive Homoflex construction makes strength member and tube virtually inseparable, assures longer, trouble-free service life. Uniform inside and outside diameters permit faster, easier, *safer* coupling . . . faster, fuller flow.

Strong, light weight, and "flexible as a rope", Homoflex Hose adds up to real labor and cost savings wherever you use it around the plant. Let your R/M Distributor show you the many advantages of Homoflex and other types of R/M rubber hose for factory use.

- **SUPER-STRONG**
- **PRECISION BUILT**
- **LIGHT WEIGHT**
- **FLEXIBLE AS A ROPE**

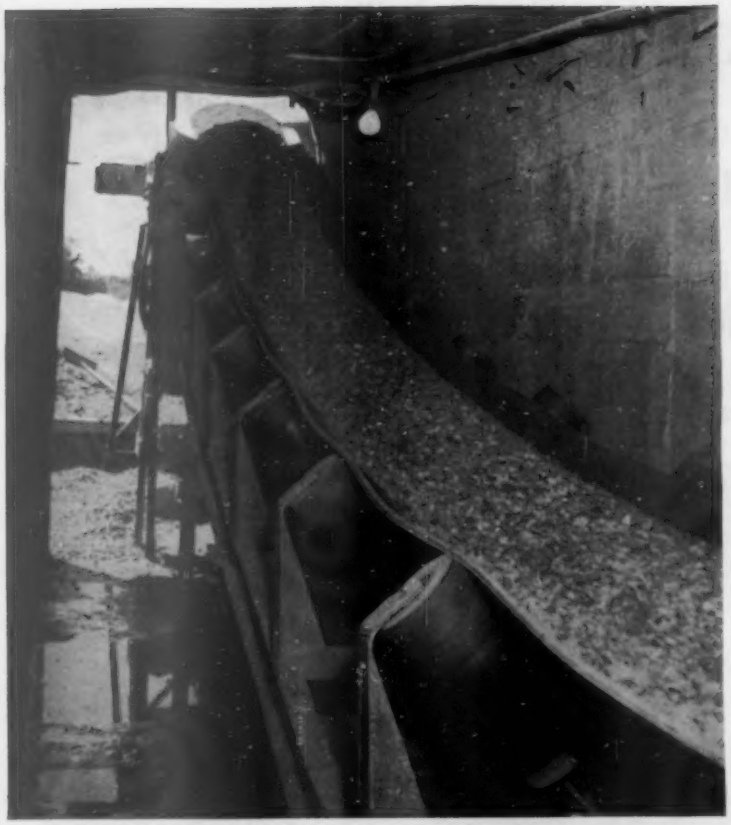
Write for Bulletins M694 and M610

RM-1029

RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

RM

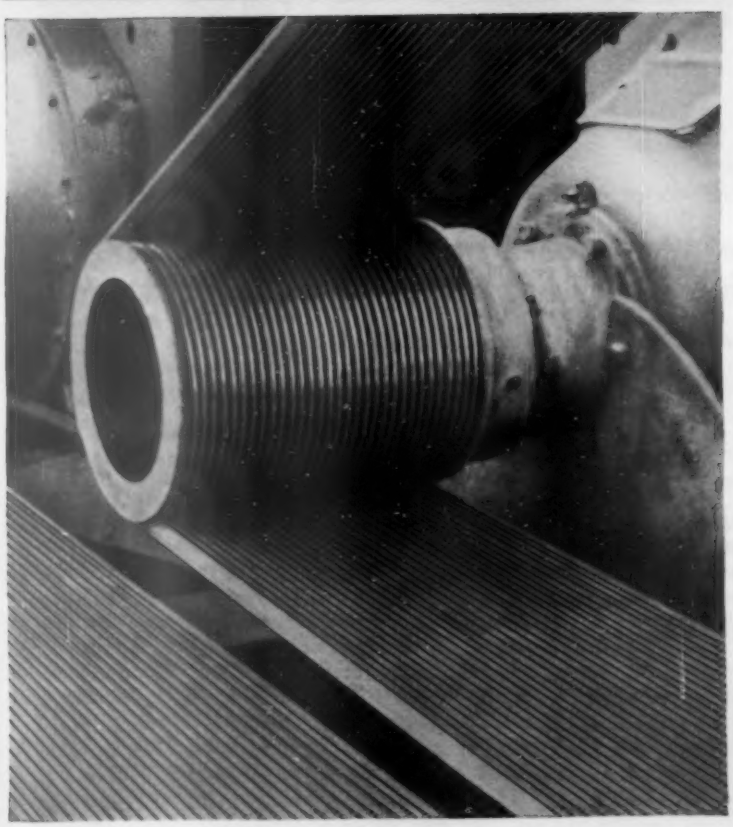
ENGINEERED RUBBER PRODUCTS ..."MORE USE PER DOLLAR"



RAY-MAN CONVEYOR BELT

Engineered for 45° Idlers

You can now get up to 60% greater hauling capacity—save up to 20% on conveyor costs—as compared to using regular 20° idlers. Ordinary ply belts are too stiff and boardy to do the job—Ray-Man's exclusive flexible construction and built-in stress compensation is *guaranteed* to take the sharp angle of 45° idlers *without* ply or cover separation at the hinge line. Learn how Ray-Man Conveyor Belt opens up a whole new era of conveyor design . . . permitting larger loads . . . narrower conveyors —assuring longer cover wear, lower handling costs! Write for Bulletin M303.



R/M POLY-V® DRIVE

More Power— in *Less* Space *. . . with Reliability*

A *single unit* V-ribbed belt across full width of the drive-sheave—*not* an assembly of V-belts—enables patented Poly-V to deliver much *more* power in the same space as a V-drive . . . or *equal* power in much *less* space! Single unit belt design also eliminates belt "length matching" problems . . . minimizes equipment down-time and belt replacement costs. Belt speed ratios remain constant from *no* load to *full* load to provide the smoothest running, coolest running—*longest wearing* drive you can install. Maintain groove shape. Just two sections of Poly-V Belt meet every heavy duty power transmission requirement. Write for Bulletin M141, or call your R/M Distributor.

CONVERT TO RM POLY-V and BE SURE!

By PAUL A. KING, Member, New York Bar

Work Rules—a Hot Issue Getting Hotter

Rigid work assignment rules hike costs. And the best time for management to nip obnoxious work rules and practices is at the collective bargaining table.

Plant costs zoom when a machine operator is not permitted to adjust or handle minor repairs to his machine —when he is compelled to call over a specialist, an electrician, or a carpenter, for example.

Cost-conscious Arbitrator Marion Beatty helped Duval Sulphur & Potash Company (Houston, Tex.) avoid getting into this kind of a bind. He ruled: When changes in technology call for different skills, tools, or processes, there is ample reason for taking a task away from a craft that previously had handled it. Here are the facts in the case:

Duval's shuttle cars operated on electricity that was fed through the old-time trolley wire and pole. The pole was frequently removed to avoid damaging it. This job was handled by the electricians whose contract gave them jurisdiction to "construct, maintain, or trouble-shoot on any electrical equipment or circuit." But Duval simplified the job of trolley-pole removal by a series of plug-in operations. Made it hardly more difficult than plugging in an electric toaster. From then on the shuttle car operators took the trolley poles off and re-attached them. This the electricians still wanted to do. But this, said Arbitrator Beatty, was no longer their task. He discharged their grievance with these words: "The fact that invention has lessened work for a given craft and created a new operation for another craft does not of itself necessarily prove a contract violation."

Arbitrator Beatty treated this employer well. Other arbitrators may not see eye to eye with him. The best time to get rid of costly work rules and practices is when you sit around the collective bargaining table—not when you stand before the arbitrator's desk.

Arthur M. Ross, director of the University of California's Institute of Industrial Relations at Berkeley, advised management at a Labor Reform Act symposium not to be bashful in making work-rule demands at negotiating time: "The problem of work rules and practices cannot be swept under the rug. Oversized crews do exist in some operations. Unnecessary standby and overtime assignments are sometimes required." He continued: "Work separations—restrictions as to what work can be assigned to particular departments, job classifications, or crews—are excessively rigid in some plants. Management has the social function of striving for efficiency and must be expected to oppose these tendencies."

But what do you do about worker opposition? Cushion the impact, suggests Ross. He pointed to three recent contracts which embodied this principle:

(1) The contract between Pacific Maritime Association and the ILWU sets up an earning stabilization fund to temporarily indemnify longshoremen against technological displacement.

(2) The contract between Armour and its unions set up a nine-man committee to work on technological change problems and backed it up with $500,000.

(3) The contract of the eastern, western and southern carriers with the maintenance employees provides for advance notice of impending technological changes—and discussing ways of minimizing the impact on employees with the union.

Three Hearings in One Day

One arbitrator can handle more than one case at a hearing. Even if the company objects.

Investment portfolios operate on the theory that it's foolhardy to put all your eggs in one basket. It might be just as foolhardy to have one arbitrator handle more than one case during a single hearing. One employer balked—wanted separate hearings for each of three cases. Two cases involved pay rates; the third, seniority. Arbitrator Carl Schedler insisted upon taking all three cases on at the same time. Said Schedler: "To hold, in the absence of a clear and unambiguous provision, that the labor agreement will not permit an arbitrator to hear more than one grievance is contrary to the general practice in this country."

Incentive System Nixed

This simple and effective day-work incentive system operated well until an arbitrator threw a monkey wrench into the works.

At the end of each week the imaginative foreman of a label pasting line in a shoe factory toted up his group's average. Below-average employees got a pep talk with innuendoes of "boost it or else." Up went their averages. A hint to the wise being sufficient, those above the average also worked harder. They wanted to put more distance between their averages and the newly made group averages. The system worked well—like a Florida dog track. The faster the dogs ran, the faster ran the much-harried rabbit. But one day one employee whose average fell below the rapidly rising line average was fired for inefficiency. Then the roof fell in.

The discharge was referred to Arbitrator Whitley P. McCoy who reinstated the fired employee. He reminded

"We've reduced our scrubbing time from 70 to 7 man-hours ... and our floors have never before been so clean!"

— says Foreman of
BURNY BROS. BAKERY, CHICAGO

Garage and stockroom floors in Burny Bros. large, modern bakery get daily scrubbing with a *Job-Fitted Combination Scrubber-Vac* and *Setol Cleanser*

THEY'RE an unbeatable team to speed the cleaning of oily, greasy floors. *Here's why:* A *Scrubber-Vac* completely mechanizes scrubbing. It applies the cleanser, scrubs, flushes if required, and picks up (damp-dries the floor) — *all in one operation! Job-fitted* to specific needs, a *Scrubber-Vac* provides the maximum brush coverage consistent with the area and arrangement of the floors. Its teammate, *Setol Cleanser,* is specially designed for the greater speed of *combination-machine-scrubbing* ... emulsifies grimy oil and grease *instantaneously* for fast, thorough removal by the machine's powerful vac. Moreover, *Setol* retains its strength longer than average alkaline cleansers. This, too, speeds the cleaning process ... saves on materials ... and cuts operating time of the machine, which in turn reduces labor costs. The *Scrubber-Vac* shown above is *Finnell's 213P,* for heavy duty scrubbing of large-area floors. It's *self-propelled,* and has a 26-inch brush spread. Cleans up to 8,750 sq. ft. per hour (and more in some cases), depending upon condition of the floors, congestion, et cetera. (The machine can be leased or purchased.) *Finnell* makes a full range of sizes, and *self-powered* as well as *electric* models ... also a full line of fast-acting cleansers. In fact, *Finnell makes everything for floor care!* Find out what *you* would save with *combination-machine-scrubbing.* For demonstration, consultation, or literature, phone or write nearest *Finnell Branch* or Finnell System, Inc., 2502 East Street, Elkhart, Indiana. Branch Offices in all principal cities of the United States and Canada.

FINNELL SYSTEM, INC.
Originators of Power Scrubbing and Polishing Machines

Everything FINNELL for Floor Care

BRANCHES IN ALL PRINCIPAL CITIES

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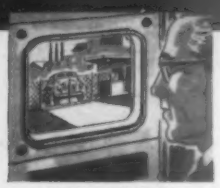
TV CAMERA



PLANT SECURITY

PROCESS CONTROL

OPERATION OBSERVATIONS

Makes closed-circuit TV practical for your plant

Closed-circuit television has been proved an effective, flexible tool for modern industry. This new all-transistor camera by Philco now makes industrial TV practical and economical for *every* plant, regardless of size. Compact, self-contained and highly reliable . . . it requires no special attention and only a minimum of routine maintenance. The brilliance and definition of Philco's picture are unsurpassed . . . even in areas of low light level.

Philco specialists will assist you in planning your system to insure the most efficient use of industrial TV in *your* plant. Write for complete information and your copy of the Philco guide to TV in Industry.

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Famous for Quality the World Over

Begins on page 198

the company that this was a day-work job. Day-work jobs should have fixed standards. Besides, standards of any kind should be known to the workers in advance. Here the standards were on a make-them-as-you-go basis. No worker knew where he stood until the week was up, and then it was too late.

Arbitrators sometimes approve averages as standards but not where they are always on the rise as in this case.

No Agreement, No Meeting

How long do you have to bargain when the contract is opened mid-term on non-wage matters?

Mid-term contract openings on wage issues are frequent. Less frequent are non-wage openings. For example, a mid-contract opening on employment security, such as in one of the Westinghouse Electric contracts with the IUE. When the union calls for a reopening and the company responds, how much bargaining must the parties do before the matter can be put to bed again?

The Westinghouse reopener clause provided that the union could strike on Nov. 1, 1958, if the two parties didn't reach agreement on employee security. On Aug. 21, 1958, Westinghouse and the IUE started talking. Many meetings were held until the union indicated in November that further meetings were unnecessary. The parties simply couldn't agree. On Dec. 21, Westinghouse wrote the union that an impasse had been reached, that it had completed its obligation to bargain. It was all over. In January, 1959, however, the union asked for a February meeting but said nothing about changing its position. There was no indication that the impasse was broken. No meeting, answered the company. The union filed an unfair labor practice charge.

NLRB Trial Examiner Eugene Kennedy found that Westinghouse's obligation to bargain had terminated. However, the ruling might have been different if the union had come back in January with an expressed willingness to make concessions. He wasn't sure in such a case that he'd say the company's duty to bargain had terminated on the November strike date. But, fortunately, he didn't have to rule on that one.

Rule-Breakers Lose Arbitration

If the union doesn't follow the grievance procedure to the letter, arbitration is out, ruled a New York court.

Here's one you can be sure unions are going to paste in their books and remember a long time. Employers, too. Remington Rand asked the court to deny the union's request for arbitration because: (1) The grievance hadn't been reduced to writing. (2) The first two steps of the grievance procedure had been by-passed. (3) No attempt had been made by the two-party appointed arbitrators to select a third before the American Arbitration Association made the appointment.

The union pointed out that: (1) The formal requirement of a written grievance fell into disuse many years

Turn to page 205

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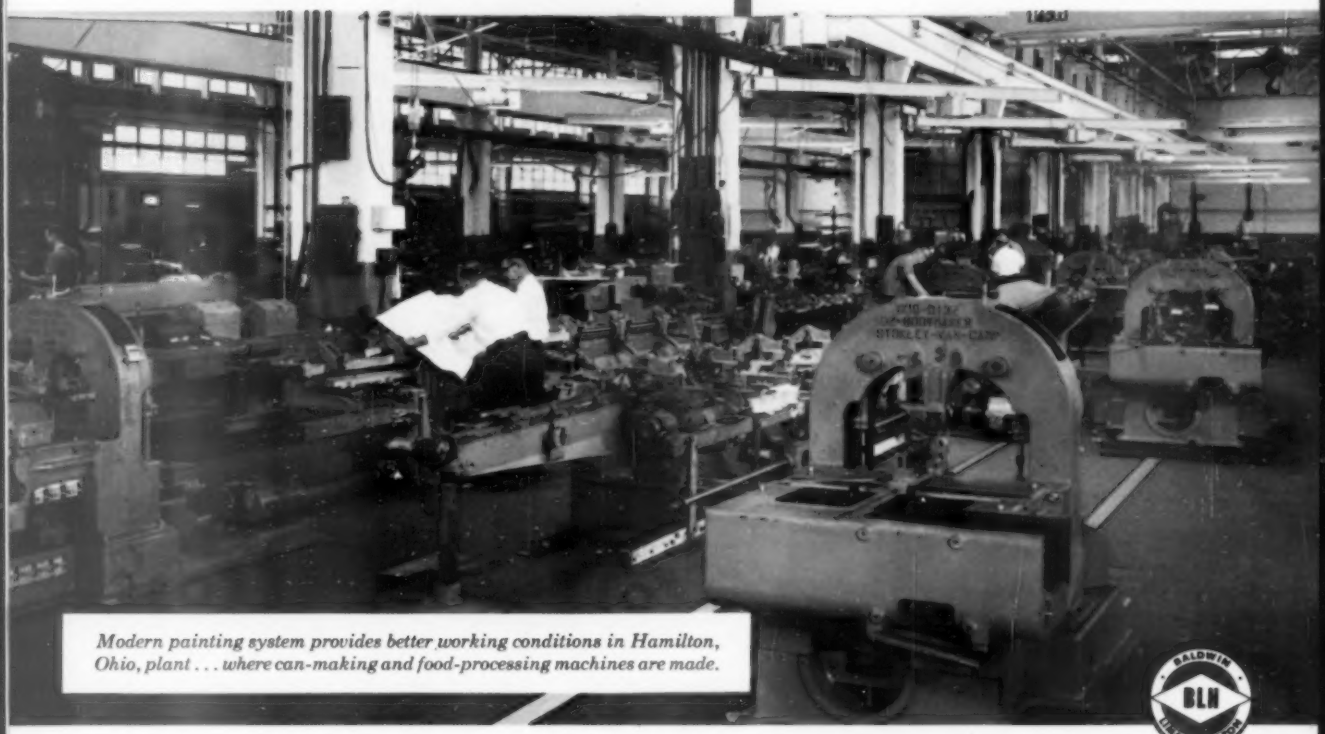
For more facts Circle 483 on Reader Service Card ➤

BALDWIN-LIMA-HAMILTON CORP.

USES PITTSBURGH COLOR DYNAMICS®

to improve production efficiency and safety



Modern painting system provides better working conditions in Hamilton, Ohio, plant . . . where can-making and food-processing machines are made.

Greater productive efficiency, higher morale and fewer time-loss accidents. These are the chief benefits from the use of Pittsburgh's painting system of COLOR DYNAMICS at the Hamilton, Ohio, division of the Baldwin-Lima-Hamilton Corp.

The versatility and scope of the engineering skills of this organization are world-famous. Its Hamilton division includes plants which build heavy-duty Diesel engines, power transmissions for submarines, and components for atomic aircraft and guided missiles. Other plants build elephant-type and railroad shop machine tools as well as compacting and other types of hydraulic and mechanical presses.

The plant shown, repainted according to COLOR DYNAMICS, produces can-making machinery and special automated equipment for food processors and packagers.

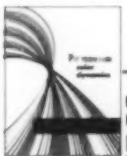
"Work areas are made more cheerful and pleasing," comments William F. Boyle, vice president and general manager at Hamilton, "by the use of COLOR DYNAMICS hues of high reflectance. Eye-rest and focal colors on machinery and lower walls relieve eyestrain. Our operators see their tasks better. Workmanship and productivity are improved. Safety colors on overhead cranes and other material-handling equipment, as well as in hazard areas, lessen danger of time-loss accidents.

"Our workers are so proud of their improved surroundings they help to keep work areas clean."

Test the effectiveness of COLOR DYNAMICS in your plant. Use it in a department, or on a machine or two, and see the difference it makes. You'll find it costs no more than conventional maintenance painting.

How you can get a modern color plan of your plant—FREE!

• We'll be glad to send you a free copy of our fully illustrated book on COLOR DYNAMICS for industry. It explains this modern painting system simply and clearly. Better still, we'll be glad to prepare a comprehensive color plan of your factory, without cost or obligation. Call your nearest Pittsburgh Plate Glass Company branch and arrange to have a representative see you. Or mail coupon at right.



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CBS-TV—Tuesday Evenings

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IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

How Protection Program of Control Instrument Co.

CONTROLS
COSTLY EYE ACCIDENTS

Eye injuries are far fewer and much less severe . . . lost production time plus medical costs *drop* from $5.17* per year per employee to $.56* — that's the experience of Control Instrument Co., Brooklyn, N. Y., subsidiary of the Burroughs Corporation, since installing an Eye Protection Program in June 1956.

Lost production time per employee per year down from 1.67 hours* to 1/10th of an hour; lost production hours in dollars down from $3.36* per employee to $.23* — these are significant savings.**

When *you* install an eye protection program, be sure to go *all the way* with *quality* equipment. American Optical Company can supply the *right* glasses or goggles, in the *right* frames for the man and the job. Write us or phone your nearest AO Safety Representative.

*Estimated

**Savings would be considerably higher if savings in compensation costs were included.

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Always insist on ® Trademarked Lenses and Frames

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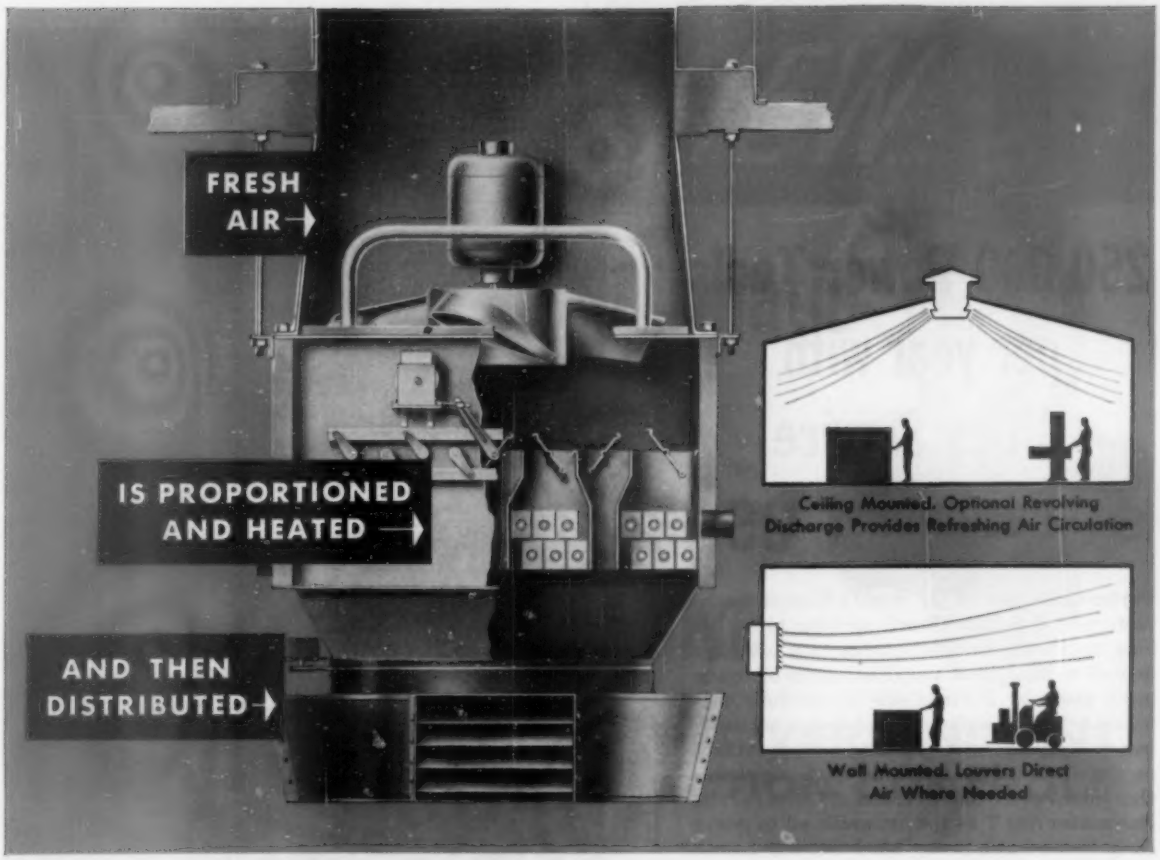
FRESH AIR
IS PROPORTIONED AND HEATED
AND THEN DISTRIBUTED
Ceiling Mounted. Optional Revolving Discharge Provides Refreshing Air Circulation
Wall Mounted. Louvers Direct Air Where Needed

• Exhaust systems function better
• Workers are more efficient
with Wing Fresh Air Supply Heaters

Wing FAS Heaters offer three big advantages to plant operators:

1. They supply make-up air to compensate for air expelled through exhaust systems, and thereby improve the operation of the exhaust systems.
2. By providing slightly positive air pressures in the building, drafts and cold air leaks are eliminated — workers are comfortable.
3. When used to provide comfort ventilation, they help improve workers' efficiency and health.

Wing Fresh Air Supply Heaters provide constant air intake while automatically maintaining desired discharge temperatures. Usually, air is discharged at room temperatures and is directed above the workers' heads so that comfort is undisturbed.

The FAS Heater shown above operates with steam or hot water. Coils cannot freeze. Direct-fired gas units are also available. All can be provided for wall or ceiling mounting in a full range of capacities. A variety of revolving or fixed discharges meet any mounting height requirement. Also suited for use in fog elimination installations.

Send for literature describing construction and giving application information.

WC131

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DIVISION OF AERO SUPPLY MFG. CO., INC.
140 VREELAND MILLS ROAD, LINDEN, NEW JERSEY
FACTORIES: LINDEN, N. J. AND MONTREAL, CANADA

WING

250,000 Power Tools per year with Cities Service Pacemaker T

Porter-Cable, one of the world's largest manufacturers of portable wood-working tools, has long known the value of quality in a lubricant as well as in a power tool. Each piece of equipment made by Porter-Cable is carefully pretested before manufacture and then continually tested for years after its original appearance on the market. It is this kind of thoroughness that led to Porter-Cable's choice of Cities Service Pacemaker 300 T as the hydraulic oil to power their Fostermatic Screw Machines and Landis Grinders.

But Cities Service Pacemaker T is more than a hydraulic oil . . . it is a multi-purpose line of lubricants suited for many applications. Porter-Cable also uses Pacemaker 300 T for lubricating valves in the plant's compressors. Pacemaker T can be used to lubricate bearings, diesel engines, electric motors, generators, reduction gear drives, turbines and in circulating systems.

Pacemaker T is available in various viscosities to give you one line of quality lubricants that can save costly warehouse space by simplifying your inventory . . . cut maintenance costs and extend equipment life. These oils have high viscosity index, excellent heat resistant properties and are chemically fortified against oxidation, corrosion, rust formation and foaming.

Contact your nearest Cities Service office and an experienced Lubrication Engineer will call to make specific recommendations for your plant on the use of Pacemaker T. Or for further information, write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Porter-Cable Machine Company
Syracuse, New York

Porter-Cable Research Engineer testing engine for new lawnmower the company will produce soon. All new products undergo extensive research and testing before production.

Backbone of Production Line is Automatic Screw Machine. Pacemaker T gives outstanding performance as hydraulic medium in these machines as well as in Landis grinders and as a general lubricant!

ago and that letters of the union's business agent constituted a reduction to writing. (2) The first two grievance steps were waived by the company's general service manager. (3) The company's failure to appoint its designee to the three-party arbitration board made impossible any attempt to agree upon an impartial chairman.

Looks like a good answer? It wasn't good enough for the New York court. Ruled the court: "Whatever may have been the manner of disposition of other grievances in the past, it appears that in this case the company insisted upon adherence to the procedural steps . . . specified in the agreement. As the union invoked the court's aid by virtue of and under the agreement, not having complied with its terms, it is not entitled to the relief here requested." The motion of the union to compel arbitration was denied.

Supervisors Mustn't Loaf

Next time your supervisor wants to fire an employee for loafing, ask him what he was doing.

This story is short and sweet. An employee was fired for loafing on the job. So was his supervisor. An arbitrator ordered reinstatement of the worker. Reason: Inadequate supervision which undoubtedly contributed materially to the loafing. Supervision was a responsibility of management. The point: Don't fire for loafing unless you're sure your supervisor did not contribute to the situation.

Equal Overtime Each Day?

Must overtime be equalized each day or can it be equalized over a longer period?

Does the clause that requires you to distribute overtime as equally as possible among employees mean you must do so for each day? Or can you adjust overtime over a longer period? Each day, ruled Arbitrator John F. Sullivan in a case involving the U. S. Industrial Chemicals Company. To do so over a longer period, specific language to that effect is required.

This seems to be the rule. But some arbitrators have permitted deviation where there was past practice to the contrary, an emergency situation, or where the lost overtime hours were few.

False Application Statements

Is that clause in your employment application about being able to fire employees for false statements a waste of time? By no means! There are times you can use it—and times you can't—but on balance it's a good provision to have in your form.

After three years of employment, a company found out that one of its employees was an epileptic. Fired him because he failed to mention this on his employment application. According to the form, any material falsification of fact was grounds for discharge. In sup-

NEW...

Airmatic S-3 Series Valve

DELIVERS INSTANT ACTION CONTROL

Positive high-speed action assures efficient control for air clutches, brakes, power feeds and accurate circuit needs. Full flow capacity shortens machine cycle time for increased production, lower costs and greater safety.

The new Airmatic S-3 Series Three-Way Pilot-Operated Valve is non-corrosive throughout, simple, compact and easily adapted to all types of pneumatic equipment. It operates without springs and by rotating the pilot head can be normally open or normally closed.

All valve deliveries are made from stock.

Specifications

Pipe size	¼, ⅜, ½, ¾ and 1" NPT
Media	Air, oil, water, chemical, vacuum, etc.
Media temperature	0-300°F
Body	Cast Naval Bronze
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For more facts Circle 487 on Reader Service Card

FILTER TIPS

New design information on Purolator Micronic® filters

This new, free bulletin gives the plant engineer complete basic data on Purolator's phenolic resin impregnated, cellulose filter elements. Micronic elements pack maximum filter area into minimum space (up to ten times more than other types); do not channel; are waterproof and warp-proof; have rigidly controlled porosity.

For your copy, write to Dept. MCI-23.

Filtration For Every Known Fluid

PUROLATOR PRODUCTS, INC.
RAHWAY, NEW JERSEY AND TORONTO, CANADA

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HYDRAULICS AND LUBRICANTS

The P192 Purolator Micronic Filter Series is a line of small, full-flow industrial filters for general lube work and for hydraulic systems up to 1,000 pounds. Features include:

- The Micronic® Filter element...resin impregnated cellulose, preformed and pleated for greater filtering area. (10 times that of any other.)
- Relief valves and corrosion-resistant parts, where needed.
- Handy, easy-to-use replacement element package.
- Mounting brackets on all filters.

Send for details and data, or write us the particulars of your problem. We'll be glad to help. Write Dept. P11-23.

Filtration For Every Known Fluid

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porting the discharge, the arbitrator stated that an employer has an obligation (considering his responsibility to furnish reasonably safe working conditions) to set up physical standards for employment. "He has the right to inquire whether an applicant meets those standards. His decision to employ is based upon the assumption that the answers he receives to questions about significant and material qualifications are true."

The union advanced the thought that a statute of limitations should apply to false answers given on an application form. After all, wasn't this fellow on the payroll without trouble for three years?

Although agreeing in principle with a statute of limitations, the arbitrator wouldn't apply it to this case. The employee's epileptic condition hadn't improved over the years. It would be different if this had been a case where the applicant had concealed the answer to a question relating to his dependability or moral responsibility. A statute of limitations might then be applicable, if over the years of employment the employee had demonstrated good moral character. In such case, the past should be dead and buried.

No Arbitration for Picketers

Next time your "no-work-stoppage, no-picketing" clause is threatened, remind the union that if it strikes or pickets you may be relieved of your obligation to arbitrate the dispute that led to the action.

A clause in the contract between Wyoming Radio and Local No. 12 of the National Association of Broadcast Employees and Technicians said in black and white: "The union will not cause or permit its members to cause, nor will any member of the union take part in any strike, either sit-down, stay-in, or any other kind of strike; or any other kind of interference or any other stoppage, total or partial, of any of the said station's operations."

This evidently wasn't black and white enough for the union. When a radio station announcer failed to join the union, the studio was picketed and leaflets were handed out in front of the stores of sponsors. At least one sponsor pulled out. Later on, when this aggressive campaign petered out somewhat, the union decided that arbitration wasn't such a bad idea. Let's arbitrate the dispute, it demanded. The company refused. The company went to a Pennsylvania court and got an injunction against the arbitration.

Said the court: "We believe that when the members of the union set up the picket line and distributed leaflets causing the loss of business, they were actually interfering with the business of plaintiff in violation of their written agreement. Such violation, in our opinion, constitutes an abandonment or waiver of their right to pursue the arbitration provision." In support of this view, the court cited several cases in other states along the same lines. It also cited a case where the employer waived his right to arbitrate because he filed an unfair labor practice charge against the union with the NLRB.

Courtesy Davey Compressor Company, Kent, Ohio

Saves 65% of screwdriving time with...

NEW ROTOR J-20S IMPACT WRENCH

JOB: Driving hex nuts and slotted screws attaching covers to portable compressors. Formerly used universal electric tools. Took 20 minutes per cover.

RESULTS: New Rotor J-20S Air-Powered Impact Wrench, with quick-change chuck and combination bit and finder, drives ¼"-20 slotted head screws to attach covers in 7 minutes. Saves 13 minutes per cover. Assures uniform tightness. Reduces operator fatigue.

Ask for a demonstration of the J-20S or other Rotor air tools on *your* job to see how they cut your costs. Write for quotation and literature on the J-20S Impact Wrench.

ROTOR AIR TOOLS: Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
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ROTOR TOOLS

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"In modern manufacturing, electrical control equipment is the very heart of mechanized and automatic operation. Because our plants have become so dependent on this equipment, the cost of 'down time' for any control failure is simply staggering. And, according to many manufacturing engineers, limit switches are the worst offenders, accounting for as much as 70% of all interruptions due to control failures."

Mr. J. S. Wilford, Editor
PRODUCTION Magazine

"At least 60% of the electrical failures causing downtime of the production machinery used in manufacturing home appliances at the Whirlpool Corporation can be traced to faulty limit switch operation. An analysis of the switch failures reveals the inability of limit switches to meet the requirements of high production equipment such as is widely used in our St. Joseph Division."

Mr. C. R. Burg, Maintenance Engineer,
Whirlpool Corporation

"75% of the electrical failures on our machines can be traced directly to limit switch malfunctions. This problem is particularly aggravating to us because we are responsible for the successful operation of our machines and their components on our customer's floor. We have spent a great deal of time engineering protective mounting schemes to compensate for the inability of today's limit switches to check the seepage of corrosive coolants and microscopic grit."

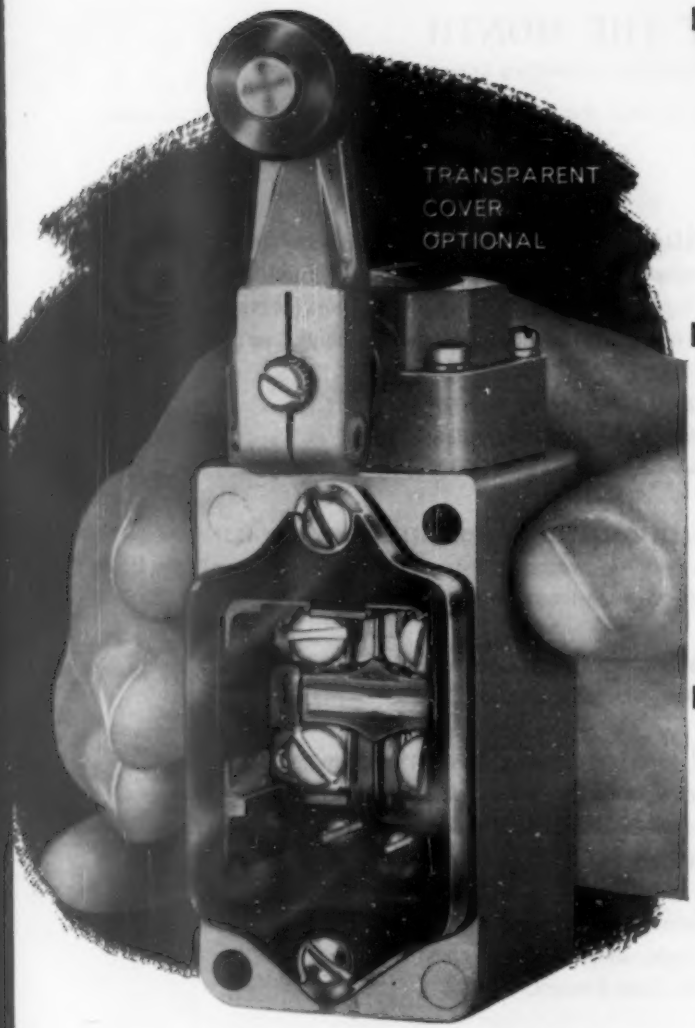
Mr. N. P. Bashor,
Director Electrical Division,
W. F. & John Barnes Company

Production's Enemy #1 MEETS ITS MASTER

Cutler-Hammer announces the *first*

- ***Tolerance Compensated***
- ***Contamination-proof***
- ***Visible Contact***

Extended Life Limit Switch



Tolerance Compensation

The new Cutler-Hammer Extended Life Limit Switch represents a startling break-through in high-precision manufacturing methods. Each sub-assembly is accurately calibrated so that in final assembly all plus and minus tolerances are precision balanced or compensated. Thus, tolerance compensation guarantees every C-H Extended Life Limit Switch will operate identically with precise repeat accuracy and ultra-long life. No binding . . . no sticking . . . no points of concentrated stress or wear.

Contamination-proof

New triple sealing positively checks seepage of all forms of oil, coolants, moisture, and abrasive grit. New cone-seal stops seepage through the operating shaft bearing. New vulcanized bellows-seal between the operating head and body eliminate the troublesome "O-ring" seal . . . won't wear . . . never needs attention. New cover seal seats on a raised lip . . . repeated opening and closing of the cover won't destroy the seal. Total-submersion life tests prove the new C-H Extended Life Limit Switch to be contamination-proof . . . suitable for even dry circuit applications.

Visible Contacts

Another Cutler-Hammer *first* . . . this new Cutler-Hammer Limit Switch provides completely enclosed but *visible* single pole double throw switch contacts. During installation, one glance shows which contacts are open and which are closed . . . no chance for wiring errors. During operations, one glance proves whether the switch is set and operating correctly. Positive visible inspection cuts maintenance costs too.

Compare these features, too!

- **One basic model is readily adapted to all desired forms of lever or plunger actuation . . . for either momentary or maintained contacts . . . for either surface or cavity mounting.**
- **Unsurpassed flexibility: 90° orientation of the operating head. 360° rotation of lever arm with a locking device that holds the adjustment. Lever operators provide clockwise, counter-clockwise, and clockwise-counter-clockwise actuation . . . easy to set on the job without disassembling the switch.**
- **Precise actuation . . . 10° pretravel—40° overtravel or 5° pretravel—45° overtravel.**
- **Visible, saddle-clamp terminals . . . no loose fibre flash-over barriers.**
- **Unitized switch mechanisms are interchangeable . . . speeds replacements when overload or short circuit damage occurs.**
- **Meets all JIC and NMTBA requirements. Easy, complete interchangeability with any widely used limit switch.**

The new Cutler-Hammer Extended Life Limit Switch installs easier, works better, and lasts longer than any of the "oil-tight" limit switches now in use. Exhaustive tests, including total-submersion life tests, confirm this fact! But don't take our word for it. Try it . . . Test it . . . Compare it. The new Cutler-Hammer Extended Life Limit Switch is completely interchangeable with any widely used limit switch. Replace your *most* troublesome limit switch installation with this new tolerance compensated, contamination-proof, visible contact Cutler-Hammer Limit Switch; and it will work better, last longer than any other you have ever used. This is the answer to your limit switch problems.

For descriptive data write for Publication ED143-C211. Cutler-Hammer, Inc., Milwaukee 1, Wisconsin.

CUTLER-HAMMER

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Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation.

FACTORY

IDEAS OF THE MONTH

By LEWIS K. URQUHART, Consulting Editor

(For more information, circle item numbers on Reader Service Card next to back cover)

If T-Metal rings no bell with you, it's probably because this exciting alloy *(Hydrometals)* of titanium, copper, and zinc is fresh out of the lab. Know then that it's tough, beautiful, corrosion-resistant, inexpensive. After reading its big story in "A Revolution in Metals," we think you'll agree. **(215)**

Spillage caused by careless drum-fillers can be dangerous or costly, or both. But it's no problem with those new polyethylene drum-filling covers *(Delaware Barrel & Drum)* designed to catch and hold overflow. **(216)**

Executive's appointment calendar *(Hinde & Dauch)* gives you the long look-ahead—3 months or 6 months at a crack. Small block of space for each day is provided for noting travel plans, meetings, etc. **(217)**

Don't paint galvanized steel till you've read new brochure *(American Iron & Steel Institute)* titled (why not?) "Painting Galvanized Sheets." **(218)**

Booklet of the Month has to be "The Story of Competition in the American Market" *(Du Pont)* which tells what every management man should know—i.e., how competition brings to the American consumer the widest range of products and services—and most bountiful living standard in history. **(219)**

Carloading check charts *(Signode)* illustrate correct procedures for wall-anchored, free-floating, controlled-floating loads; show shipping-room and loading-dock people how to prepare, drape, strap, load boxcars. **(220)**

Your offices need a good going-over? An 84-page booklet *(Art Metal)* on office standards and planning is full of ideas for you. **(221)**

Noise exposure fatigue with its inevitable production lag and all-too-frequent lost-time accidents can be minimized with new ear muffs *(International Latex)* that permit normal conversation while shutting out high-level shrieks, high-frequency whistles, other noise that drives workers to drink. **(222)**

Buy for $18,000 or lease for $540 per month. New D-E 60 *(Clary)* is lowest-cost digital computer yet produced (says its maker). Simplest, too. With 8 hours' training any good typist can operate it. **(223)**

Flooring guide *(Monroe)* tells where, when to use 30 company products to maintain, repair, patch, resurface interior and exterior floors. **(224)**

No left-handed monkey wrenches, so far as we know. But you *can* get a set of 10 left-handed taps *(DoAll)* conveniently arranged in a special wooden block and ready for that inevitable emergency use. **(225)**

Your favorite filer will really be in business with one of those new mobile shelf-filing trucks *(Remington Rand)*. It's a self-contained work station. Filer can stand on platform to reach top shelves; platform seals to floor automatically when in use, then restores to casters. **(226)**

Seeing and sawing simultaneously is safe for circular-saw operators whose pinkies are kept out of the buzzer by shatter-resistant Plexiglas shields *(Brett-Guard)*. Adjustable to "impossible-to-guard" cuts. **(227)**

192 hours of continuous use is record hung up by new typewriter ribbon *(Columbia)* on newspaper teletypewriter without appreciable wear in fabric and with nominal ink depletion—and still legible image. **(228)**

Machinists should go for handy-dandy T-slot cleaners *(Kelm)*. T-slots are de-clogged with one end, chips spooned out with other. **(229)**

No paint to corrode and maybe contaminate materials. That's one advantage of molded-plastic assembly bins *(Stackbin)*. They stack, of course, and tapered-front design makes semi-circular set-ups a natural. Length, 8; front width, 3¼; rear width, 4½; height, 2½ inches. Grey. **(230)**

Jet Band is new bandsaw blade *(Millers Falls)* containing high proportion of vanadium carbide. We hear that at regular speeds and feeds it outlasts carbon bands 3 to 1. And on high-production machines it matches performance of high-speed steel bands—at a 25% saving in cost. **(231)**

Your 1960 Security Benefits is newest in long line of help-yourself booklets *(Employee Relations, Inc.)*. Single copies or in bulk for employee distribution. All illustrated, pocket size, 16 pages or more. **(232)**

For your shop library if you machine aluminum, a new 120-page manual *(Alcoa)* titled "Screw Machine Stock . . . Estimating and Operating Data." Gives properties, specifications, estimating data, shop practices. **(233)**

You're more likely to get regular and correct lubrication of machinery and equipment if you're using self-sticking labels *(Brady)* to identify lube points, types of lubricant to use, frequency of application. **(234)**

Lignum vitae is an old, old, self-lubricating material you may know little about and should know more. At least one company *(Lignum Vitae Products)* will be happy to enlighten you. **(235)**

Turn the page

"Equal to RLM" ...Anyone can Say it!

BUT

Only the RLM LABEL can GUARANTEE IT with a continuous RLM Test Program of Inspections by the ELECTRICAL TESTING LABORATORIES

"Equal to RLM" is a claim that is often made by sellers of industrial lighting equipment. No finer compliment could be made to the high quality RLM specifications!

However, RLM is more than a group of widely approved standards for industrial lighting equipment. RLM is also a guarantee of conformance. This guarantee is backed by the unbiased tests conducted by an independent testing laboratory—The ELECTRICAL TESTING LABORATORIES OF NEW YORK! These tests assure not only compliance with standards but every effort is made to insure that *every fixture* shipped to the buyer will be of uniform quality.

In the entire lighting industry there is no equal to this testing program... so in the truest sense there can be no such thing as "equal to RLM." RLM is unique... distinctive and above price to the buyer who wishes unbiased proof of quality.

THE FINAL INGREDIENT OF BEING SURE

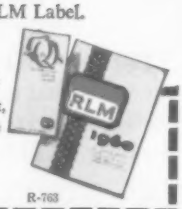
Into each factory go ETL representatives to secure for test and certification purposes, samples of the manufacturer's RLM-labeled units.

PRODUCT QUALITY
LIGHTING QUALITY

These TWIN QQ's to Industrial Lighting Success
are guaranteed with all lighting equipment bearing the RLM Label.
Return of the coupon brings you full information.

RLM STANDARDS INSTITUTE, Suite 8292, 326 W. Madison, Chicago 6, Ill.

Please send me free a copy of the new "TWIN QQ's" pamphlet, the latest RLM SPECIFICATIONS BOOK, and names of the leading manufacturers offering RLM-labeled lighting equipment. (Please write name, company and address in margin below.)



R-763

(For more information, circle item numbers on Reader Service Card next to back cover)

Riveting aluminum? New 52-page booklet *(Reynolds)* tells just about everything you need to know, answers questions like: How can shear strength be determined? What's best hole size for a hot-driven rivet? **(236)**

Micrometer *(Glass Labs)* dials exact visual readings from zero to 1 inch. Friction stop. Lock screw. Measuring faces of tungsten and carbide. **(237)**

For automatic transfer of large parts from, say, machining to welding to assembly, a channel-iron "box frame" *(Gear-O-Mation)* operates overhead, raising parts to index them to succeeding operations. **(238)**

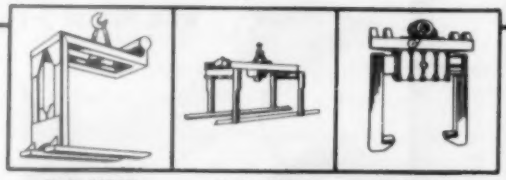
Painter's Partner *(Spatz)* is something new in blowtorches. Propane gas is fed to torch through hose attached to fuel supply tank, which can be hung on ladder rung, placed on floor, or hitched to workman's belt. **(239)**

Lok-Cor is subdrainage pipe *(Republic Steel)* with positive lock seam (can't unwind) and helical corrugations for strength and flexibility. **(240)**

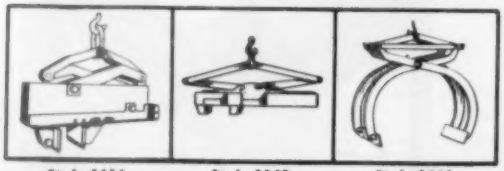
Plastic suit *(Safety First)* fits comfortably over ordinary work clothing, is priced low enough to be economically disposable. **(241)**

Turn the page

MANSAVER® GRABS
Reduce Your Costs



Style 1274M Pallet Grab | Style 1142 Sheet Grab | Style 1418 Coil Grab



Style 1616 Coil Grab | Style 1145 Coil Grab | Style 1061 Paper Grab

These are but a few of the over 1000 Mansavers available in manual, semi-automatic, fully-automatic, or power-operated styles for handling sheets, coils, pallets, racks, bars, billets, paper rolls, boxes, barrels, and other materials. Ask our District Representative into your plant to study your problem for presentation for our solution.

MANSAVER INDUSTRIES, INC.
3147 East St., New Haven, Conn.
Also Manufactured in England and France

For more facts Circle 493 on Reader Service Card

Only the New TALK-A-PHONE has these exclusive features!

- **DYNASONIC SELECTOR.** Select station performance, intermix or change as needed.
- **MULTI-MAGIC STATION SELECTOR.** Up to 50-station capacity in same attractive cabinet.
- **"PRIVATE" or "NON-PRIVATE" MASTERS and STAFFS.** Converse in privacy, answer calls from a distance.
- **NOISE-FREE, VOICE-RANGE POWER.** Rugged, All-Transistor, high-gain amplifier provides exceptional clarity and naturalness of tone.

PLUS . . . Incoming Call Chime; Busy Signal; Monitoring Signal; External Relay Control; Reciprocal Power Supply . . . all as standard features of the New TALK-A-PHONE

Proportioned like a book, only 3-inches high. The look and feel of fine-grained leather, with the strength and rigidity of steel. In charcoal gray and brushed chrome.

A.I.A. File Number 31-i-51

Write for free brochure and name of nearest distributor | TALK-A-PHONE CO. Dept. F-2, 5013 N. Kedzie Ave., Chicago 25, Illinois

For more facts Circle 494 on Reader Service Card

No more scratches on plastic eyewear if cleaned with new rayon Sight Savers *(Dow Corning)*. Loosely woven surface absorbs dirt particles. **(242)**

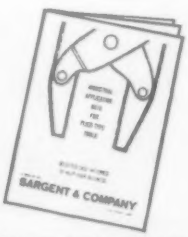
Pigskin safety oxfords *(Haus of Krause)* look like casual sport shoes, weigh a pound or more less than conventional safety oxfords. Special foundation for box makes weight-saving possible. Pigskin uppers assure long wear, are specially tanned to resist water, acids, alkalis, ordinary soil. **(243)**

Color-Plast is a shim and gasket material *(General Gasket)*. Comes in 12 gages, each in its own color. Color card shows at a glance which you combine to get exact thickness you need. Perfect seal every time. No cement. **(244)**

VSMF stands for vendor-specs-microfilm file. It's a new catalog service *(Rogers)* containing engineering specifications on all types of components and materials used in missiles and aircraft. Average finding time: less than 15 sec. Coming soon: similar files serving four other industries. **(245)**

Synthetic slings of nylon, dacron, or polypropylene *(Amco)* safeguard men (because of extremely light weight) and materials (because the soft fibers won't scratch highly polished, machined, or painted surfaces). **(246)**

FREE BOOKLET may solve your hand tool problem . . .



It's yours for the asking: Sargent's new booklet "Industrial Application Data for Plier-Type Tools." Contains detailed case histories on cutting, shaping, crimping, punching and holding problems solved with Sargent precision hand tools. Describes and illustrates Sargent's parallel action, compound hand pliers, punches and special purpose tools many of which are designed on a custom basis. Mail coupon now for your copy.

SARGENT & COMPANY, New Haven 9, Conn. **Dept. 22-B**

Gentlemen: Please send me your new booklet "Industrial Application Data for Plier-Type Tools."

Name_____ **Title**_____

Company_____

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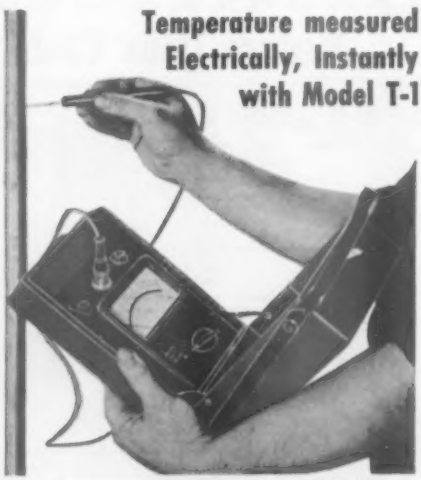
Sargent & Company, New Haven 9, Conn.
Manufacturers of quality locks, hardware and tools since 1864.

Temperature measured Electrically, Instantly with Model T-1



For contact or immersion. Solids, liquids or gases—Instant reading. Accurate to 1½°C.. Range minus 20° to plus 180°C.. A Siemens product. For production, laboratory, maintenance or field applications. Utilizes handy probe, ½" in diameter. Case included. •Literature

AMERESCO, INC.
9 Center Avenue, Little Falls, N. J.

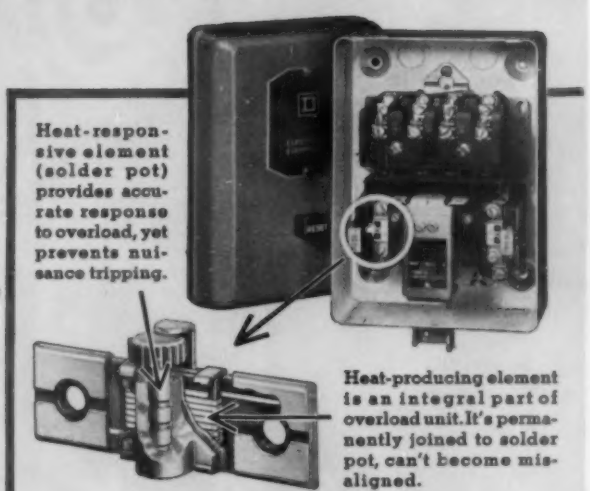
For more facts Circle 495 on Reader Service Card

For more facts Circle 496 on Reader Service Card

ONLY SQUARE D STARTERS WITH ONE-PIECE OVERLOAD RELAYS GIVE ABSOLUTE PROTECTION!

• Only Square D makes thermal overload relays with 1-piece construction—and only with 1-piece construction can you *know* you've installed the heater correctly. Square D 1-piece overload relays can be installed only one way. They are factory-assembled, individually tested and calibrated, completely tamper-proof. Repeated tripping will not affect accuracy.

You *pay* for overload protection—be sure you *get* it. Insist on Square D 1-piece overload relays for *absolute* protection.


Heat-responsive element (solder pot) provides accurate response to overload, yet prevents nuisance tripping.
Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

EXCLUSIVE— 1-piece Overload Relay for *ABSOLUTE* Protection!

Mail coupon today for simple "jig-saw" demonstrator—see why only Square D gives absolute protection

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Please send me information on Square D magnetic starters, along with your simple 3-minute "jig-saw" demonstrator

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STANDARD REPUBLIC MATERIALS HANDLING PRODUCTS SIMPLIFY CONTAINERIZATON

REPUBLIC WEDGE-LOCK® PARTS STORAGE UNITS are easy to load or unload from either side. And, the heavier the load, the tighter the grip, because patented Wedge-Lock construction includes a post that will not buckle; a concealed sway-proof joint, and a reinforced shelf that does not sag. Unlimited shelf arrangements. Capable of exceptionally high stacking. Republic Storage Engineering specialists will help you plan.

NEW REPUBLIC DRUM RACKS assure stacking of more in-use drums in less space and at lower cost than ever before. Each rack supports two loaded 55-gallon drums. Racks with drums can be stacked to any practical height. Standard fork-lift trucks can pick, move, and stack as many tiers of drums at one time as capacity permits. Shipped knocked down, with fasteners for quick and easy assembly.

REPUBLIC PB-127 COLLAPSIBLE BOXES lower the cost of storage or shipment of empty stacking boxes. Heavy-duty corrugated design delivers long, efficient service at lowest per-year cost. Boxes can be tiered when loaded or empty, collapsed or set up. All parts permanently attached. Ideally suited to shipping castings and other heavy items, the PB-127 Box offers up to 66% savings in storage space.

Moving raw materials through production lines to shipping is faster, easier, more economical, with standard Republic Materials Handling Units . . . key to *containerization.*

Strong, sturdy, Republic Units are designed and produced to withstand abuse of everyday, workday service. Many special materials handling problems can be solved from Republic's full line of standard units, at big savings for you.

Let the materials handling engineers of Republic's Berger Division work with you in solving your materials handling problems. Call your Republic-Berger representative, or write direct.

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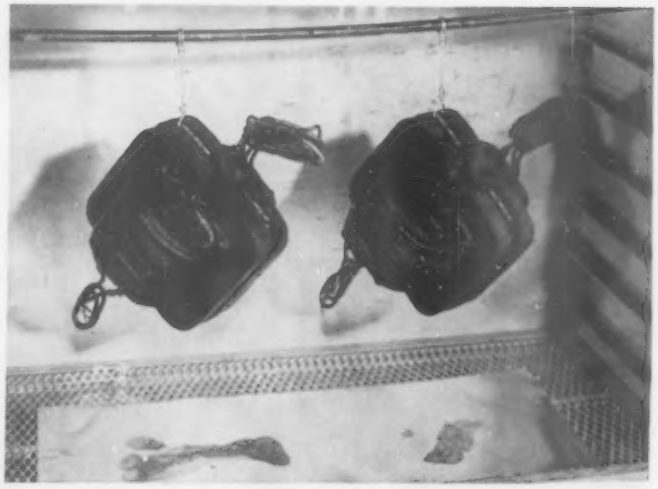
For more facts Circle these numbers on Reader Service Card:
498 Storage Units, 499 Drum Racks, 500 Boxes, 501 Materials Handling Units.

For more about these items, circle numbers on Reader Service Card next to back cover.

New Varnish Cures Fast, Has Less Run-Off

A new Class H silicone dipping and impregnating varnish is as easy to process as most Class A and Class B varnishes and has many advantages. The material cures in six hours at 150 C.—50 C. below temperatures required for other silicone varnishes. It is said to have greater heat stability than any other varnish known, and the run-off is substantially lower. It will now be possible to produce Class H units on equipment designed for Classes A and B since the new varnish does not require high-temperature curing ovens.

The greater thermal stability of the new product permits smaller, lighter-weight, and reliable units when it is used with other Class H components in power transformers, servomechanisms, and electronic devices designed for high temperature rise. *Dow Corning Corp.* (Circle 173).



174—Wound-Wire Porous Metal, Poroloy CS, is a new low-cost metal for fluid filtration and other uses. It's designed for mildly corrosive conditions. Metal is wound by high-precision process into hollow cylinders or cones. *Bendix Filter Div., Bendix Aviation Corp.*

175—Plastic Putty that cures at room temperatures into solid epoxy resin makes a strong edge for fastening sandwich structures. Holes drilled through the plastic provide firm points of contact. Load is shifted through edge into the structure. *Narmco Resins & Coatings Co.*

176—Coating, known as Skalix, prevents scale formation on metals during heat treatment. Applied by spraying or dipping, the coating adheres to metal at furnace temperatures. As the metal cools, the coating pops off by itself. *North American Aviation, Inc.*

Versatile Nylon Film Has Many Advantages

Extruded nylon film and sheet now come in thicknesses from 0.002 to 0.60 in. and in widths to 18 in. The new product possesses all the chemical, physical, and mechanical properties of nylon.

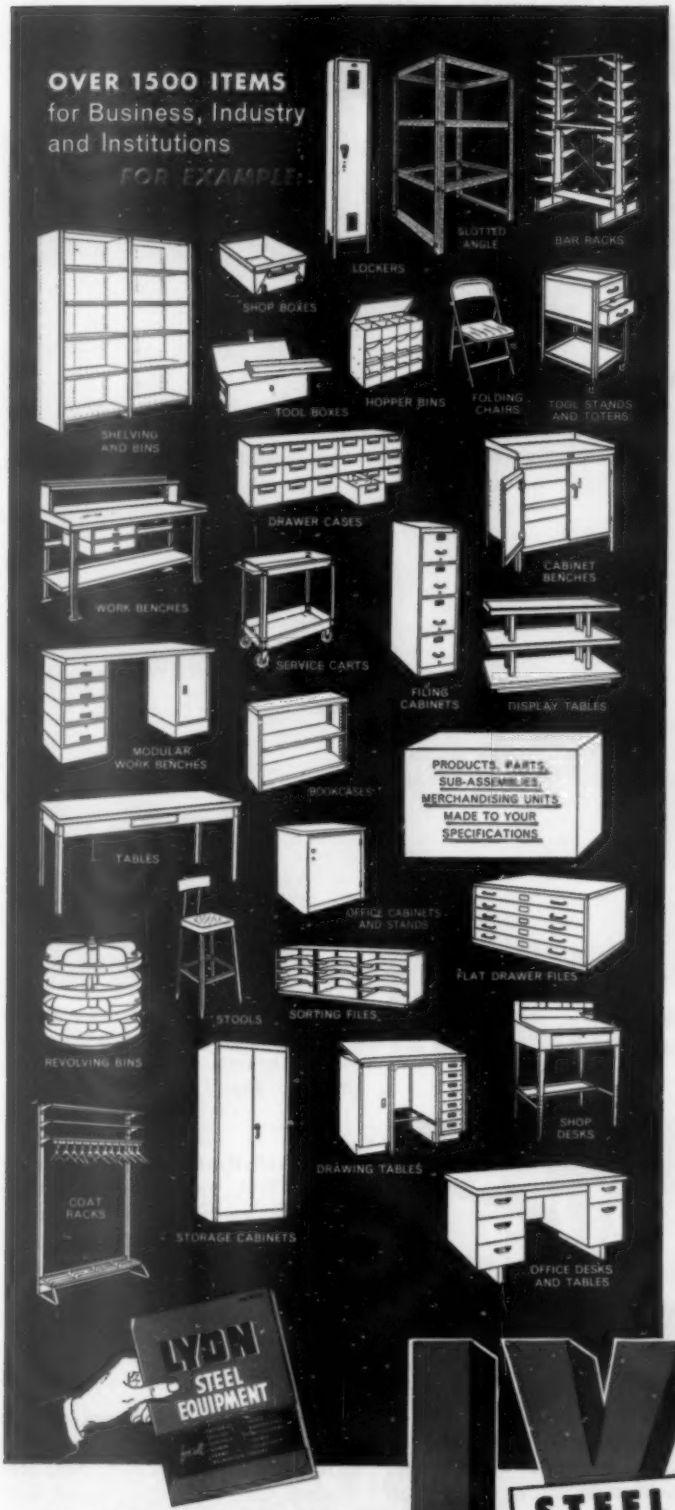
The material is grease-, abrasion-, and vapor-resistant, can be steam-sterilized, has a low permeability factor and a low coefficient of friction. Since it is available in unlimited lengths, the material is good for mass production stamping of thrust bearings, electric insulators, oil bearing items, etc. It is also economical for use in the fabrication of parts needing anti-friction properties. *United States Gasket Co.* (Circle 177).

This Vinyl and Rubber Hose Means Safety

Rubber hose reinforced with rigid Geon vinyl is ideal for applications where dusts and gases create explosion hazards.

The new product has been designed to replace wire reinforced hose which might cause sparking and explosions when the rubber exterior wears through and the wire is exposed. The hose consists of a rubber core wrapped with a continuous coil of $\frac{3}{16}$-in. round, rigid vinyl rod for added strength. Both the core and coil are then wrapped with an exterior layer of abrasion-resistant rubber. *B. F. Goodrich Chemical Co.* (Circle 178).

Turn the page



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"THIS LUBRICANT PRACTICALLY ELIMINATED BEARING REPLACEMENTS"

Says- C. O. SPARKS, INC.
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"Prior to using LUBRIPLATE, we were replacing shaker screen bearings within 60 to 120 days due to lack of or faulty lubrication. Since we started using LUBRIPLATE seven years ago, we have only replaced two shaker screen bearings and these because of natural wear. We now use LUBRIPLATE for general lubrication throughout our plant."

W. T. Ellington, President
Mundo Engineering Co.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE GREASE AND FLUID TYPE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

LUBRIPLATE is available in grease and fluid densities for every purpose . . . LUBRIPLATE H. D. S. MOTOR OIL meets today's exacting requirements for gasoline and diesel engines.

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

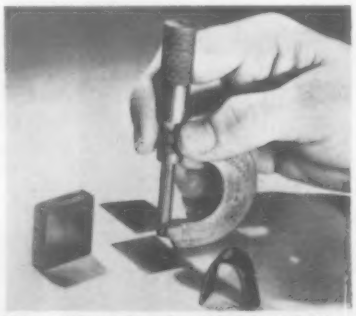
For more about these items, circle numbers on Reader Service Card next to back cover.

179—Fire-Resistant Coating called Thermastic withstands flash temperatures to 5000 F. This heavy-duty coating is for use over steel, aluminum, and special alloys; protection of wooden structures, etc. Resists abrasion, has high impact strength. *Mathews Paint Co.*

180—Plastic Sealer-Filler can be sawed, sanded, finished, and painted like metal. Repairs made with BondZall plastic are permanent, will not rust, disintegrate, or corrode. Seals; builds up assembly line and casting production damages. *Fybrglas Industries, Inc.*

181—Noise Reduction Panel, made of low-cost acoustical material, has sound absorption qualities comparable to acoustical tile or dry wall partition. One side of panel is perforated; it's 2⅜ in. thick; is easily cut with regular carpenter tools. *Elof Hansson, Inc.*

182—Coustifab Fabrics are made of lead powder-filled vinyl-coated cotton duck and glass. They're fire-resistant, flexible, of various weights, have many uses. One fabric, laminated with aluminum foil, has adhesive backing—easy to use in tape form. *Cordo Chemical Corp.*



183—High-Density Metal, Mallory 3000, can be cold worked and formed, thus permitting fabrication of a wide range of shapes. Metal is available in rolled sheets or slabs 0.010 to 0.250 in. thick, widths to 8 in., and lengths to 40 in. *Mallory Metallurgical Co.*

184—Sheets of Paint, pre-dried, self-adhesive, make painting easy. Paint is sealed between two layers of paper—one protects adhesive, other paint. You take paper off adhesive, press paint surface down, remove surface paper—painting is done! *Morgan Adhesives Co.*

185—Fibrous Glass Roof Coating contains special additive, Thermo-Flo #17, that makes it easy to apply in the coldest weather. Supercote stays fluid in any temperature, adheres to damp or frost-covered roofs.

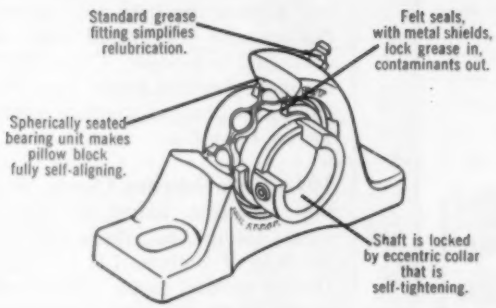
186—Concrete Floor Compound cures, hardens, seals, and dustproofs in one application. Dekote is a fast-drying, clear, ready-to-use liquid that's easy to apply to fresh concrete or existing floors. Seals concrete floors against most acids, oils, greases. *Tretol, Inc.*

187—Anti-Rust Spray, called Sprayon No. 604, prevents corrosion on precision instruments, tools, dies, motors; protects machined parts between operations or in storage. Applied as fine mist, the aerosol penetrates into joints and crevices. *Sprayon Products, Inc.*

188—Coating Fluid, based on colloidal silica, makes a paint surface so slick dust can't cling. Soil Retardant Concentrate is mixed with water, then sprayed, brushed, or roll-coated on interior or exterior surface. Hardens in 15 min. *E. I. duPont de Nemours & Co.*

Turn the page

hoover quality PILLOW BLOCK BALL BEARINGS


Standard grease fitting simplifies relubrication.
Felt seals, with metal shields, lock grease in, contaminants out.
Spherically seated bearing unit makes pillow block fully self-aligning.
Shaft is locked by eccentric collar that is self-tightening.

Simplify bearing application problems caused by inaccuracies of assembly or machining of equipment. Use *Hoover Quality* SP series pillow block ball bearings that adjust automatically to shaft misalignment in any direction.

Installation is quick and easy. Elongated bolt holes in the base of the pillow block simplify mounting. Eccentric collar forms a self-tightening shaft lock.

Hoover Quality features assure long, trouble-free life under normal duty and shock load conditions. SP series pillow block, flange bearings and machine units are available in shaft sizes from ¾″ to 2 15/16″.

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As tough and rugged as money can buy. Work benches are adaptable to many combinations, and provide maximum sound deadening. Borroughs' line also includes tool stands, utility carts, shop desks and tables, portable and semi-portable work bench kits, many accessories.

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FACTORY / MATERIALS NEWS

Begins on page 218

For more about these items, circle item numbers on Reader Service Card next to back cover.

MATERIALS LITERATURE

189—Plastic Sheets, Tubes. This 20-pager illustrates applications and lists grades and properties of Panelyte laminated sheets, rods, and tubes. Describes more than 50 laminate grades, gives sizes. *Cadillac Plastic & Chemical Co.*

190—Fatty Acids From Tall Oil. Technical bulletin (24 pages) discusses supply factors and properties. Tells how Pamak fatty acids are used in protective coatings, core oils, plasticizers, cleaners, and detergents. *Hercules Powder Co.*

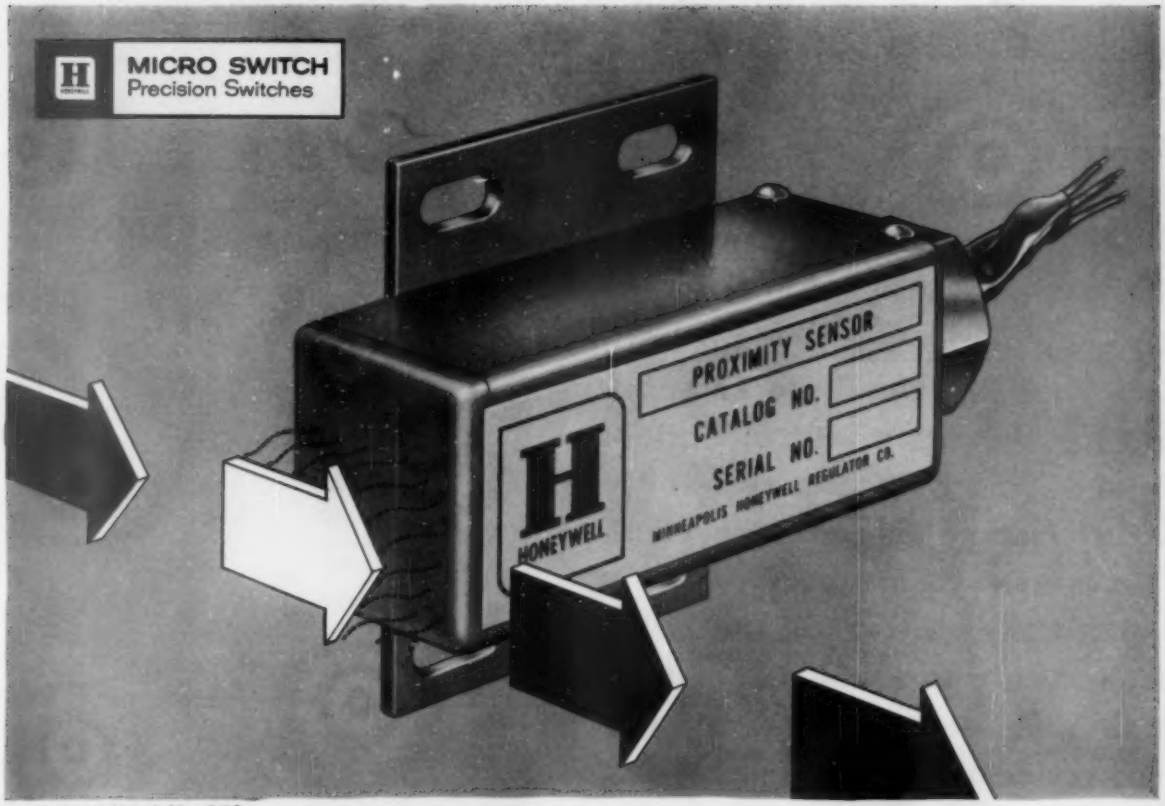
191—Fluxes and Solders. Here's a 10-page catalog (C-1) that covers supplies for all soldering applications. Products shown include general-purpose, stainless steel, aluminum, rosin, and non-corrosive fluxes. *Johnson Mfg. Co., Inc.*

192—Copper-ply Wire. Information on use for bare and insulated communications wire, rural distribution, drop, masonry tie, and other wire is given in 8-page bulletin (No. 203). Data on gage tolerance, grades, etc. *National-Standard Co.*

193—Plastics, Fibers. Application and engineering data on laminated plastics and vulcanized fiber are contained in 8-pager. Covers 21 of the most common grades of plastics and six of fiber; also special grades. *Taylor Fibre Co.*

194—Resin Selection Charts. Selection of resins, foams, or bonding agents for specific jobs is easy with the help of Bulletin 121 (4 pages). Defines various terms. Charts offer formulations for each application. *Plastic Associates.*

195—Tubing Steels. Here's a 6-pager (TDC-193) that covers two general-purpose steels for tubing applications. Lists types, sizes, finishes, qualities, shapes, fabrication details. *Babcock & Wilcox Co.*



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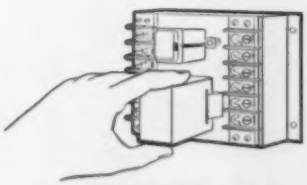
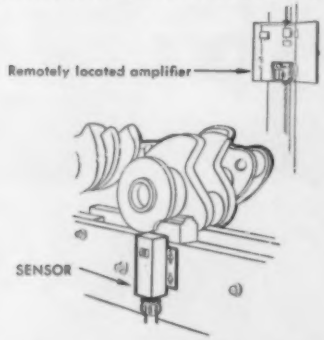
BUSY SWITCH
without a moving part!



Plug-in relay in amplifier cuts downtime.



Amplifier is separate, may be remotely located.

Honeywell Proximity Switch opens new ideas for up-dating machines and methods

This amazing new switch solves many automation problems that previously could not be tackled. It detects metal parts that pass within ½" of the sensor—over 600 operations a minute—without ever touching them. Perfect answer where rough parts or corrosive atmosphere may damage a mechanical switch or where the delicate finish of a product might be marred by physical contact.

The Honeywell sensor has no moving parts to wear out, need never be replaced! It has a rugged stainless steel face. The sensing unit is sealed against cutting oils, filings, humidity, sand and dust, can operate submerged if necessary.

A Proximity Switch can be your answer to difficult switch problems, but be sure it is a product of Honeywell research. Contact the nearby MICRO SWITCH branch office and ask for Data Sheet No. 163.

MICRO SWITCH, FREEPORT, ILLINOIS
A division of Honeywell
In Canada: Honeywell Controls Limited, Toronto 17, Ontario

Honeywell
MICRO SWITCH Precision Switches

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See LOCAL SOURCES Section This Issue ▶

Yale Gas Trucks

with fluid-coupling transmission are tops with operators and planners. Operators go for the low cowl with its wide visibility and greater safety, and for the deep-cushioned seat with easy accessibility from both sides. They like the finger-tip controls for hoist, tilt and direction. Planners find that long clutch life (due to fluid coupling, which eliminates metal-to-metal contact in transmitting power to the drive wheels) cuts down-time and maintenance costs. In addition, this truck saves space through high stacking with optional triplex mast and a short turning radius for narrow aisles. Capacities, 2000-3000 lbs. Yale makes the full line, so when a fluid-coupling gas truck is recommended, you can be sure it's the right truck for the job!

For full information, call your Yale representative or send for free brochure #5003E to The Yale & Towne Manufacturing Co., Materials Handling Div., Philadelphia 15, Pa., Dept. GT6.

Yale Materials Handling Division, a Division of The Yale & Towne Manufacturing Company. Manufacturing Plants: Philadelphia, Pa., San Leandro, Calif., Forrest City, Ark. Products: Gasoline, Electric, Diesel and LP-Gas Industrial Lift Trucks Worksavers • Warehousers • Hand Trucks • Industrial Tractor Shovels Hand, Air and Electric Hoists.

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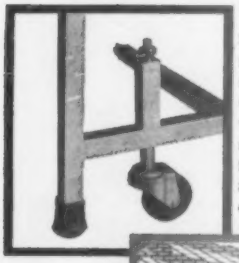
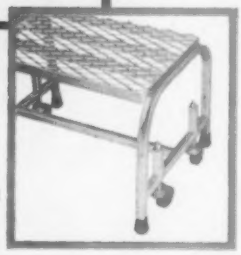
Roomy steps
Solid underfoot
Easy to handle

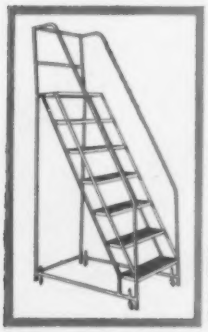
Alco-Lite 1 to 12 step all-steel Ladder Stands



Roll Easily!
Special casters retract automatically under users weight—9 steps and over feature foot activated front caster brake.

Sturdy!
SQUARE tubular steel frame. All-welded steel construction. Safe expanded metal treads.





Special taper lets you stand closer to your work. Entire unit finished with rust-resistant aluminum coating. FREE CATALOG!

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FACTORY BOOKS

Machines, Economics, Enjoyment

This book combines business reading with pleasure. Originated as a business research project, *Precision Valley* turns out to be an enjoyable history of the machine tool companies of Springfield, Vt.

In this history, author Wayne Broehl, Jr. (professor of business administration, Dartmouth College), makes the people who pioneered machine-tool building in the United States come to life. No dull narrative, the book paints a colorful, realistic picture of the life and times of these early manufacturers. And what it describes is typical of the problems and decisions facing pioneers in any heavy industry.

The book tells the fascinating story of how Jones and Lamson Machine Company was persuaded to move from Windsor to Springfield —in a manner very familiar to business climate salesmanship of today. You can read about how James Hartness came from a job as a machinist in Cleveland to become shop foreman, later plant superintendent, then president of J. & L. Hartness tells of the day in Cleveland when electric lights were first installed in the shop:

"We were afraid the glare would spoil our eyes, and I remember distinctly going down to the public square to buy colored glasses to protect my eyes against all this dangerous new light."

And so this true-to-life story goes. It tells how Hartness encourages his landlord's son to give up clerking and become a draftsman. A few years later the draftsman, Edwin Fellows, designed a new kind of gear-maker. Hartness later helped him found the Fellows Gear Shaper Company. Still later, another Hartness protégé designed a new kind of grinder. And in the same way William LeRoy Bryant was helped to start up the Bryant Chucking Grinder Company. It's this kind of American folklore that makes the book's serious intent enjoyable as well as rewarding.

Woven into the narrative is a blend of historical background and economic perspective. The reader will close the book with an unusual grasp of the dollar problems that face basic equipment manufacturers. (Reviewed by L. R. Bittel.)

Precision Valley by Wayne G. Broehl, Jr. Prentice-Hall, Inc., 70 Fifth Ave., New York 11. 274 pages. $5.95.

An Ulcer, Gentlemen, Is an Unwritten Poem

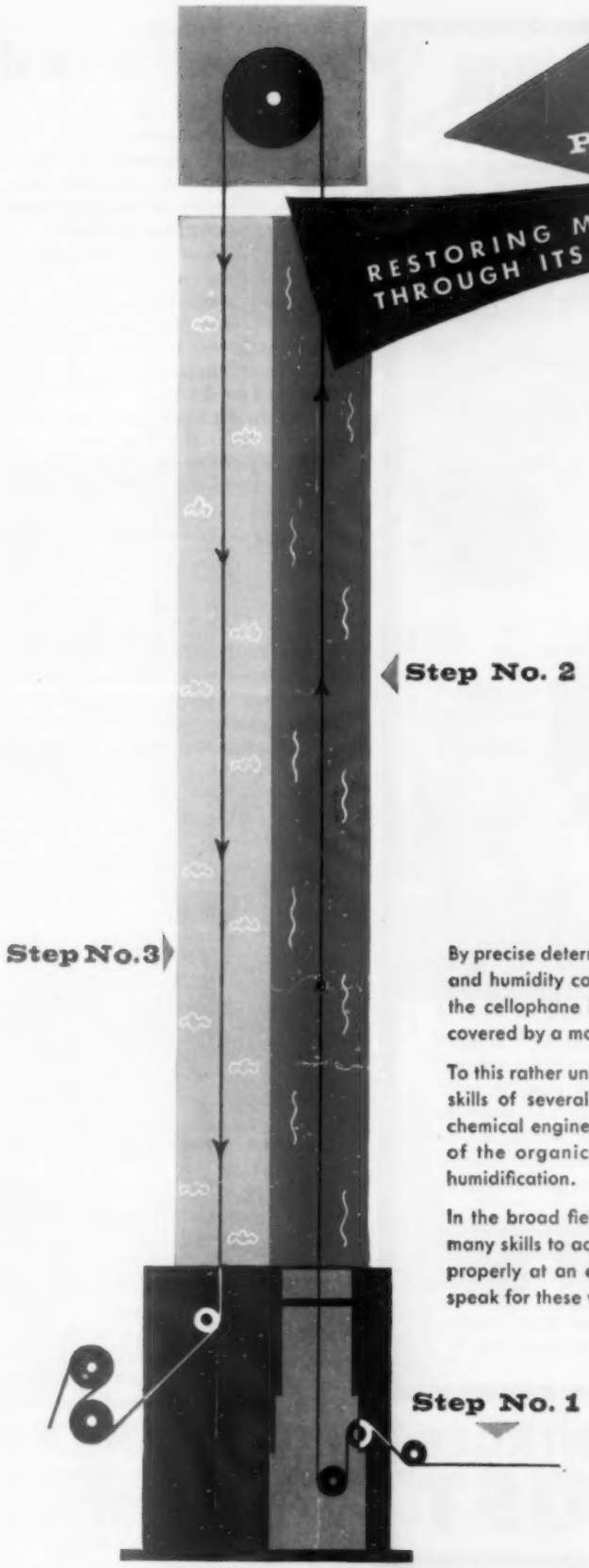
That's one of the headings in *Toward the Liberally Educated Executive*, a collection of writings and speeches on the need for wider mental horizons than plant, office, or business community. Other headings clearly spell out the book's content. Here are a few: "Labor, Leisure and Liberal Education, Social Innovation, Bell Telephone's Experiment in Education, Stability in an Era of Change."

What does poetry have to do with plant operations? Not much, if you count only the problems of the moment. But this book encourages you to lean back and contemplate the place plant problems should have in your life. You may find it an upsetting exercise. But if you can get past the shock of having your most important values held up to a very bright light, you're sure to enjoy—and profit from—this book. (Reviewed by George A. Hoy.)

Toward the Liberally Educated Executive (revised edition), by Robert A. Goldwin and Charles A. Nelson. The Fund for Adult Education, 200 Bloomingdale Rd., White Plains, N. Y. 129 pages. (Free, believe it or not.)

How to Insulate

Here is a book designed to help the plant and maintenance engineer solve industrial insulation problems at all temperature levels. *Industrial Thermal Insulation* covers every phase of insulation—piping, equip-



THIS WAS A PROBLEM

RESTORING MOISTURE TO CELLOPHANE THROUGH ITS MOISTURE-PROOF COATING

The Product

• • • Coated Cellophane Strip

Step No. 1

• • • Coat with a moisture-proof material on a Waldron Tower Coater

Step No. 2

• • • Completely dry the coating and remove all the solvent simultaneously in the up-pass side of the Ross Tower Dryer. By this necessary drying action, the original and *desirable* moisture content in the cellophane sheet was reduced much below the proper level for keeping cellophane pliable. It was this reduction that set up the problem... How to restore moisture through a moisture-proof coating?

Step No. 3

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By precise determination, creation, and application of correct temperature and humidity conditions—in the down-pass side—the moisture content in the cellophane is brought up to the desired level despite the fact it is covered by a moisture-proof coating.

To this rather unusual problem involving an 'Engineered Atmosphere,' the skills of several kinds of engineers were brought to bear, particularly chemical engineers, because to solve the problem required a knowledge of the organics and their behavior under high temperatures and humidification.

In the broad field of drying, curing, and baking, it takes a blending of many skills to achieve the desired objective: the end product conditioned properly at an economic cost. Thousands of successful Ross installations speak for these very skills in the J. O. Ross organization.

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For details on Pangborn's engineering knowledge and experience, talk to the Pangborn man in your area or write PANGBORN CORPORATION, 2100 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control and Blast Cleaning Equipment—Rotoblast® Steel Shot and Grit.* ™

Pangborn CONTROLS DUST

Begins on page 226

ment, and structures. Deals with sub-freezing temperatures as well as those up to 2000 F. Includes chapters on principles, economics, materials, and application methods.

Case studies of 26 typical applications covering a variety of plant equipment and utilities illustrate the author's points. The book clears up such questions as: How should I insulate my underground pipe line? Why do I need a vapor barrier? And why is the optimum thickness of insulation from the heat return per dollar standpoint not necessarily the most economical? (Reviewed by Warren J. King.)

Industrial Thermal Insulation, by Allen C. Wilson. McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36. 295 pages. $9.

Epoxy Resins: Market Survey and Users' Reference shows ways of saving money through the use of epoxy resins. Survey covers 1000 companies manufacturing, selling, or using epoxies. Cites specific instances of how firms actually cut costs by using epoxies as protective coatings, as a part of products, or in some other way. But the authors warn that epoxies are not a miracle material and potential users should first check comparative costs and performance data. Such data are also an important part of this book.

Epoxy Resins: Market Survey and Users Reference—a Study by Nine Graduates of Harvard Business School. Materials Research, Box 363, Cambridge 39, Mass. $18.50.

Industrial Man—deals with the businessman and the business organization. The problems, goals, tasks, personalities, and philosophies of American business, and the men who run it are discussed in a series of articles. The editors have compiled what they believe is a cross-section of current thinking on these subjects. The contributors are social scientists and economists, as well as industrial leaders. Good readability is the product of clear, lucid writing.

Industrial Man—Businessmen and Business Organizations, edited by W. Lloyd Warner and Norman H. Martin. Harper & Bros., 49 E. 33rd St., N. Y. 16. 580 pages. $6.50.

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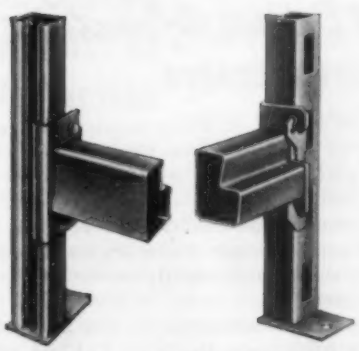

10

Left—smooth line construction of aisle side of post and stringer eliminates hazardous protrusions. Stringers raise and lower like a window. Right—note rigid connection when stringer is "locked" to post.

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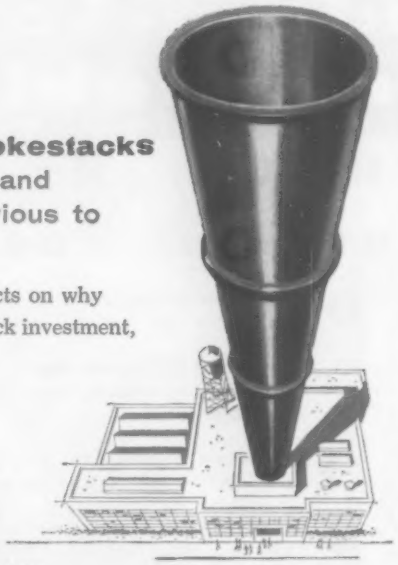

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AND BRADLEY *Duo washfountains* FOR THE OFFICE STAFFS

With foot control of water supply and the self-rinsing bowl, the Duo-Washfountain is rapidly gaining favor in washrooms for executive and office staffs—in food markets, schools, institutions, medical offices. Greater convenience, maximum sanitation, no faucets to manipulate—no unsightly water left by previous user.

To have all details write for free copy of Duo-Washfountain Bulletin K-1204 to Bradley Washfountain Co., 2215 W. Michigan St., Milwaukee 1, Wis.

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FACTORY FILMS

Armstrong Acoustical Fire Guard introduces a new concept in fire-safe acoustical tile ceilings. Film shows how the sound-conditioning material acts as an efficient fire barrier that requires no additional fire protection above the ceiling. Explains how use of the pre-fabricated ceiling helps in obtaining rated fire protection for metal decks or steel supporting members. One scene shows ceiling being installed in an Underwriters' Laboratories test furnace to determine its fire-resistance. 16mm, sound, 18 min. For loan, write:
Armstrong Cork Co., Dept. I. S., Lancaster, Pa.

Arc Welding Electrode Selection tells the story of the many factors essential to correct electrode selection. Outlines step-by-step procedure that covers base metal identification, welding currents, welding positions, thickness and shape of base metal to be welded, joint design and fitting. 16mm, color, 25 min. Write:
Hobart Brothers, Troy, Ohio.

Pathway to Profits demonstrates in-the-floor type conveyor systems for moving four-wheel platform trucks. Shows how Trukveyor installations can solve problems of handling merchandise and reduce operating costs in assembly plants, warehouses, distribution centers, other locations. 16mm, sound, color, 12 min. For loan, write:
Link-Belt Co., Public Relations Dept., Prudential Plaza, Chicago 1.

Fire Barriers by Overly shows fire-testing and applications of new metal-and-glass fire and smoke screen. The film illustrates actual fire tests, shows how to place the screens in buildings to provide areas of refuge. 16mm, sound, color, 8 min. For purchase, write:
Overly Mfg. Co., Greensburg, Pa.

Catalog of Business and Professional Films is a list of specialized 16mm films (with sources) about new products, industrial processes, and cost-saving techniques. All films are available for loan. For free copy of catalog, write:
Modern Talking Picture Service, 3 East 54th St., New York 22.

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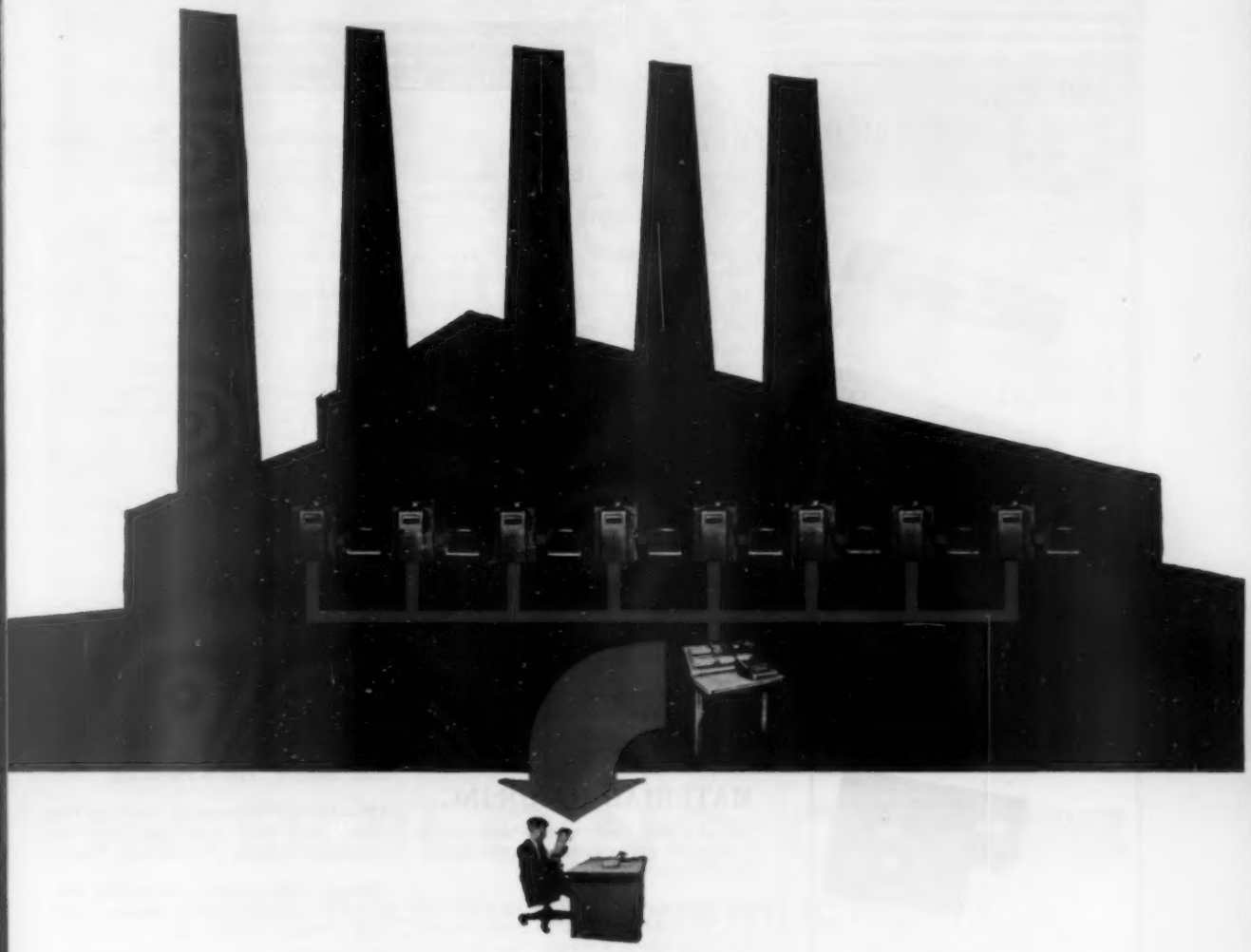
do you get production reports in time for a decision...or a post mortem?



IBM 357 Data Collection System speeds "live" production data to management in time for action

Production line data must be "live" if it's to be of use in management decisions. The new IBM 357 Data Collection System now makes this information available as soon as it occurs . . . in readily usable punched card form. The IBM 357 greatly increases the volume and speed of data flowing from production line to management, yet drastically reduces the amount of paper work involved.

Each central receiving station of an IBM 357 System is served by up to 20 compact, wall-mounted input stations, strategically located near work areas to receive data directly from the production line. Facts fed into the input station are flashed to the recording center and automatically punched into IBM cards, ready for processing. The IBM 357 System is compact, economical, flexible. It can be expanded or modified at any time to handle changing needs.

Your local IBM representative can tell you about the money-earning advantages of the new IBM 357 . . . call him today. The IBM 357 Data Collection System, like all IBM data processing equipment, may be purchased or leased.

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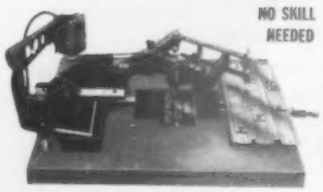

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ADVERTISERS' LITERATURE

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

BUILDING

255—Plant Sites. Here's a nine-booklet portfolio on "Industrial Colorado." Colorado Dept. of Development.

256—Steel Culverts. Booklet explains new installation service for Armco Drainage & Metal Products, Inc.

257—Plant Sites. Two booklets on plant site advantages of San Jose, Calif. Greater San Jose Chamber of Commerce.

258—Rolling Steel Doors. Catalog G-60 gives data on manual, mechanical, or electric types. R. C. Mahon Co.

259—Smokestacks. Free bulletin contains full facts on why they are good investment. A. O. Smith Corp.

MECHANICAL

260—V-Belt. Bulletin M141 gives information on single unit V-ribbed belt. Manhattan Rubber Div., R-M, Inc.

261—Speed Reducers. Full facts on comprehensive line including selection and feature data. Link-Belt Co.

MATERIAL HANDLING

262—Casters. Casters and wheels catalog is complete with specifications and details. The Fairbanks Co.

263—Storage Racks. Catalog gives full data on slide and lock adjustable racks. American Metal Products Co.

264—Conveyor Belt. Bulletin M303 gives details on flexible constructed belt. Manhattan Rubber Div., R-M, Inc.

265—Self-Dumping Hoppers. Details upon request. Five sizes, ½- to 2-yd. capacity. Roura Iron Works, Inc.

266—Electric Truckster. Complete information on new gasoline model 780 truckster. Cushman Motors.

267—Palletainers. New catalog, well illustrated, has specifications and construction details. Union Steel Products.

268—Monorails & Cranes. New 52-page booklet, "Cost-Cutting with Monorails & Cranes." Louden Machinery Co.

269—Casters and Wheels. Free manual lists complete line. Types and sizes for every purpose. Darnell Corp.

270—Conveyors. Bulletin 309 gives data and varied applications for complete systems. Standard Conveyor Co.

271—Wire Rope Slings. New handbook includes types, dimensions, and rated loads. Union Wire Rope Corp.

272—Tractor Shovel Trucks. Complete data, with capacities, on all models and attachments. The Frank G. Hough Co.

273—Screw Conveyors. Book 2985 gives complete engineering data and specific applications. Link-Belt Co.

274—Package Sealing Machine. Brochure 100-60 (8 pages) gives full details on omnimatic-rotopress. J. L. Ferguson Co.

PLANT SERVICES

275—Hose. Bulletins M610 and 694 give data, structural features, applications Manhattan Rubber Div., R-M, Inc.

276—Dust Filters. Bulletins F-75 and G-579 contain helpful planning information, engineering data. The Day Co.

277—Valves. New condensed catalog shows all types of pneumatic control equipment. Johnson Service Co.

278—Intercommunication Phone. Free brochure gives complete data and structural features. Talk-A-Phone Co.

279—Valves. Illustrated literature on bronze and other types and sizes for varied applications. Wm. Powell Co.

280—Air After-Cooler. Descriptive Bulletin 130 covers structural features, other data. Niagara Blower Co.

281—Plastic Panels. Literature and specifications on new plastic panels. Buildings Div., Butler Mfg. Co.

282—Non-Slip Surfacing Material. Gives data and sample of floor surfacing material. Minnesota Mining & Mfg. Co.

283—Acoustic Panels. Free folder shows how you can solve sound control problems faster. The Eckel Corp.

284—Modular Work Stations. Bulletin 158 shows how to streamline and adapt to needs. Products For Industry.

285—Dust & Fume Control Systems. Catalog (52 pages) shows 60 different installations. Kirk & Blum Mfg. Co.

286—Steel Shop Equipment. Catalog illustrates steel shelving, work benches, tool stands, etc. Borroughs Mfg. Co.

287—Industrial Gloves. Catalog G-3 lists complete line, sizes, gages, lengths, finishes. Seiberling Latex Products.

Turn the page

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☐ **New horizons in aluminum brazing**—Covers furnace, torch and dip brazing of aluminum. 22 mins. color

☐ **Millions on the move**
How to eliminate traffic congestion. Available only within a 75-mile radius of cities with 75,000 population or more. 27 mins. color

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ADVERTISERS' LITERATURE

Begins on page 232

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

288—Steel Shop Equipment. Catalog illustrates diversified line for industrial use. Lyon Metal Products, Inc.

289—Valves. Folder No. 202-A describes plug-type bronze valves. Gives full details and features. Jenkins Bros.

290—Air Valves. Latest catalog lists sizes, specifications for all types pneumatic equipment. Airmatic Valve, Inc.

291—Air Compressors. Bulletin 3405-82 describes features of new air-cooled compressor. Worthington Corp.

ELECTRICAL

292—Motor. Details on air-cooled custom-built ball-bearing motor. Totally enclosed. Valley Electric Corp.

293—Safety Switch. Latest bulletin gives complete facts and features of construction. Square D Co.

294—Magnetic Starters. Complete information available, plus simple 3-minute "jig-saw" demonstrator. Square D Co.

295—Plug-In Duct. Bulletin SD-110 gives full facts and features of aluminum plug-in duct. Square D Co.

296—Proximity Switch. Data sheet No. 163 gives details about new switch. Micro Switch, Div. of Honeywell.

297—Bus Duct. Information on new duct for electrical distribution systems. Bulldog Electric Products Div.

PRODUCTION

298—Hand Tools. New booklet available, "Industrial Application Data for Plier-Type Tools." Sargent & Co.

299—Visible Record System. Free folders on systems for inventory, production control. Acme Visible Records, Inc.

300—Electrostatic Spray Gun. No. 2 Process brochures show examples of painting. Ransburg Electro-Coating Corp.

301—Temperature Instruments. Literature describes measurement of temperature of solids, liquids, gases. Ameresco.

302—Data Processing Systems. Brochure S-500 describes Automatic Keysort Data system. Royal McBee Corp.

303—Paint Sprayer. Bulletin A98-7 gives complete facts on airless paint-spraying outfits. Binks Mfg. Co.

Turn the page

ADAMS FACT FILE #2

PLANT AIR

Moisture Chief Cause of Trouble . . .

Every company today is looking for ways to offset the increased costs of labor, material, equipment and services. At a gasoline station you expect "Free Air", but in industry it is a major expense. Perhaps in your own plant, for an investment in a few minor compressed air system alterations, significant savings are possible.

Water, sludge, rust, oil and dirt in compressed air systems are prime causes of maintenance and production down-time. Water vapor condensing in air lines tends to corrode the piping. Also, water present in the piping may freeze during winter, causing serious reduction of compressed air supply. Such restrictions are often difficult to locate and thaw. This same line moisture may emulsify lube oil destroying its lubricating value and the resultant mixture has high fouling characteristics. Frequently, ice will form within the tool itself since expanding air cools the moisture . . . tool efficiency will be seriously affected.

Some of the Other Problems Created By Wet Compressed Air . . .

Wet compressed air is not only a construction and production tool problem. Faulty paint jobs, contaminated chemical and food products can often be traced to moisture laden compressed air. Waterhammer, unequal pipeline thermal expansion and line leaks also result from collected moisture. In addition, air lost through traps, and in blow-down of compressed air lines provide no useful work . . . represent a sizeable power loss.

You Can Lick Compressed Air Moisture Problem . . .

All of these hidden costs can be virtually eliminated by the installation of an Adams Aftercooler and Cyclone Separator between the compressor and receiver tank. By cooling discharge air to within 10° F. of cooling water temperature — guaranteed with Adams standard Aftercoolers — the moisture can be removed at the separator. Pressure loss is less than one-half pound on these units including the separator. In severe cases, moisture removal of over 90 per cent can be obtained by cooling the air with Adams 2° Aftercooler to within 2° F. of water temperature.

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For further information on how the complete line of Adams air equipment can solve your compressed air problems, write today for your free copy of Bulletin No. 712 on Aftercoolers and Bulletin No. 117 on Poro-Stone Air Filters from the R. P. Adams Company, Inc., 215 East Park Drive, Buffalo 17, New York.

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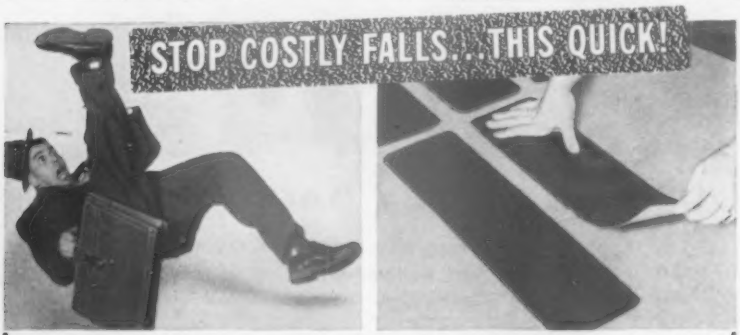

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SAFETY-WALK BRAND **Non-Slip Surfacing**

MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

For more facts Circle 521 on Reader Service Card

ADVERTISERS' LITERATURE

Begins on page 232

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

304—Mist Control. Bulletin describes in detail mist control unit for machining operations. Aget Mfg. Co.

305—Degreasing Solvent. Informative article on solvent degreasing is available. Detrex Chemical Industries, Inc.

306—Heat Transfers. Bulletin P60 gives complete data, designs, and sizes. Tranter Mfg. Inc.

307—Reproduction Materials. Free copy of booklet on Kodagraph reproduction materials. Eastman Kodak Co.

308—Label Printing Machines. Detailed information on line of printing machines. Weber Marking Systems, Inc.

309—Films. Industry-sponsored films available on loan basis for training of employees. Association Films, Inc.

310—Time Recorder, Totalizer. Brochure NR-2 gives information on recorder. Standard Instrument Corp.

311—Schedule Board. Bulletin X-500 shows application of visual control schedule board. Graphic Systems.

MAINTENANCE

312—Ladders. Free catalog gives complete data on 1- to 12-step all-steel ladder stands. Aluminum Ladder Co.

313—Rust Preventive. New catalog features 110 actual color standards and 69 photo applications. Rust-Oleum Corp.

314—Packings. Descriptive literature tells about line of packings for maintenance. Greene, Tweed & Co.

315—Scrubber-Vacuum. Ask for literature on self-powered combinations, gas or electric. Finnell System, Inc.

316—Lubricants. Informative booklet, "A Grease Schedule for Cost Control," is yours upon request. Texaco, Inc.

317—Lubricant Pump. Catalog ("77") describes features of new 5.2-hp. air-operated pump. Alemite Div., S-W Corp.

318—Unions, Union Fittings. Descriptive brochure gives full data, sizes, and applications. The Fairbanks Co.

319—Lubricants. Free "Lubriplate Data Book," a helpful treatise on lubrication. Lubriplate Div., Fiske Bros.

320—Lubricants. Booklet, "Organized Lubrication . . . Major Cost Control Factor," is yours for the asking. Texaco, Inc.

FOR RUGGED SERVICE... FOR DECORATIVE APPEAL

CORRUGATED ASBESTOS TRANSITE®

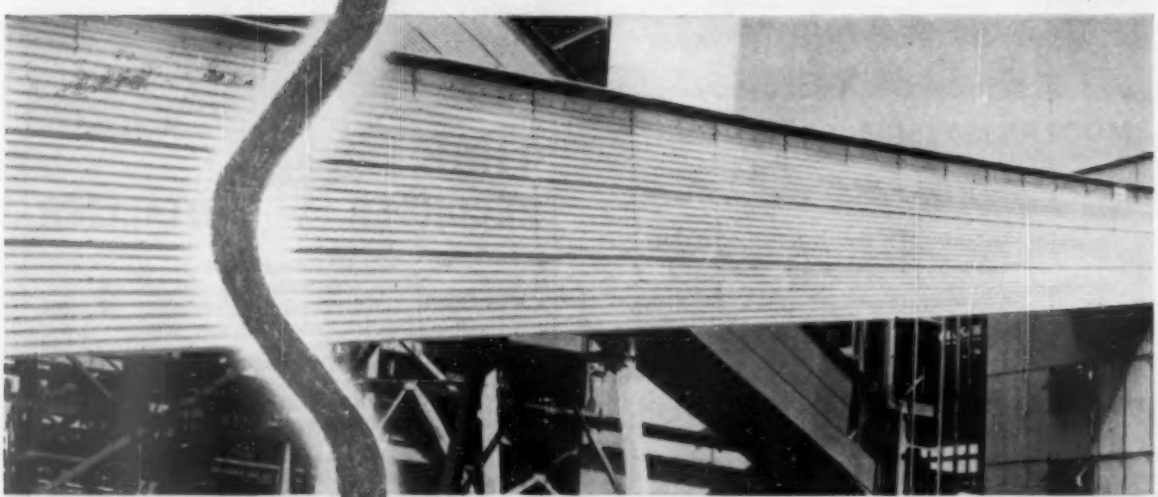
Corrugated Transite adds a modern decorative, eye-catching touch.

Corrugated Transite provides ages of service with virtually no maintenance.

Take asbestos; take cement. Form these virtually indestructible materials into carefully designed corrugated sheets, and you have Johns-Manville Corrugated Transite that wears like stone. It can't burn, can't rot, can't rust—and requires practically no maintenance.

Corrugated Transite is a neutral stone-gray color. It is attractive used alone or it harmonizes well with other materials. It is a structurally strong sheet for industrial construction or for commercial and institutional building. Also, it is often used decoratively for interiors.

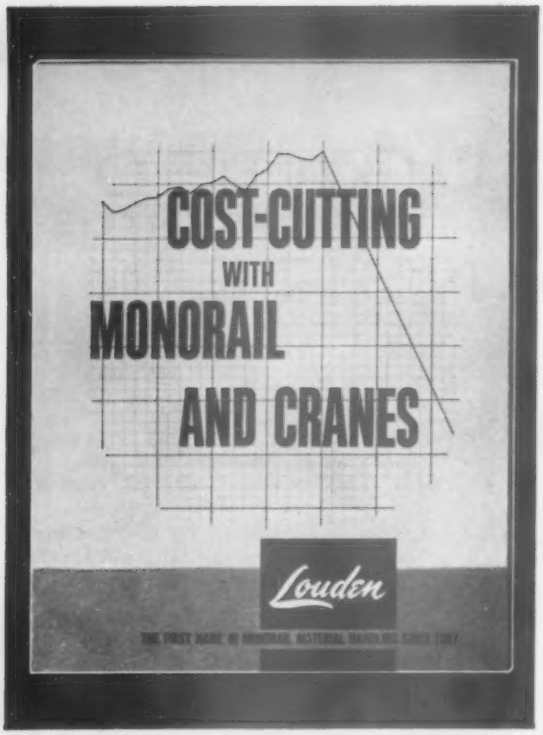
Sheets of Corrugated Transite are 42" wide (10 corrugations) in lengths up to 12'— cover big areas quickly with minimum framing. For full information on this versatile material, send for the free 32-page brochure, "Corrugated Asbestos Transite." Write to Johns-Manville, Box 158, New York 16, N.Y. In Canada, Port Credit, Ont.



The big sheets of Corrugated Transite can be erected either horizontally or vertically.

JOHNS-MANVILLE

JOHNS MANVILLE JM PRODUCTS



NEW . . . 52 PAGES OF ILLUSTRATED APPLICATIONS . . . INDUSTRY BY INDUSTRY. GET THE LATEST AND MOST COMPLETE INFORMATION ON PLANNING AND EQUIPMENT SELECTION FOR THE BEST IN MODERN MATERIALS HANDLING.

Write today. No obligation.

THE LOUDEN MACHINERY COMPANY
205 Broadway, Fairfield, Iowa
A Subsidiary of Mechanical Handling Systems Inc.

Louden

MONORAIL & CRANES

SINCE 1867 . . . THE FIRST NAME IN MATERIALS HANDLING

238 **For more facts Circle 523 on Reader Service Card**

Lewis Stack-n-Nest® TOTE PANS

IN SIZES TO HANDLE EVERY PRODUCT

16 x 10 x 5
18 x 12 x 6
18 x 12 x 8
22 x 14 x 8
22 x 17 x 10
27 x 16 x 11
34 x 24 x 19
39 x 19 x 14

WITH ACCESSORIES FOR GREATEST VERSATILITY

PAN COVERS
• Molded of Fiberglass Reinforced Polyester in colors to match pans • Snug fit — keeps out dust and dirt • "Contour offset" for safe, high stacking of covered pans • Nest when not in use • Use as trays if desired • Popular sizes — fit the 22x14x8" and 27x16x11" Stack-n-Nest pans.

DOLLIES
• Molded of Fiberglass Reinforced Polyester in colors to match pans • Four heavy-duty, easy-rolling swivel casters • "Contour offset" for safe, secure stacking of pans • Quick, easy multiple handling and movement — loaded or empty • Rugged construction for big pay loads • Popular sizes — fit the 22x14x8" and 27x16x11" Stack-n-Nest pans.

G.B. Lewis COMPANY
122 Montgomery St.
Watertown, Wisconsin

STACK-n-NEST PANS PATENTED
2,823,828 2,823,829

For more facts Circle 524 on Reader Service Card

"This $65 instrument saves me 60¢ an hour in production costs"

TIME RECORDER + TOTALIZER

what TRT is — An instrument that automatically records "on-off" time of **any machine or process.** Information is marked on a continuous, time-indexed tape. Marking stylus is **electrically actuated.** Tapes run 4 months.

what TRT does — Shows on tape **exactly when** "down-time" occurs, how long it lasts. Access window enables operator to write reason for stoppage. Visual counter totals **actual productive time.**

how TRT saves — TRT data-on-tape gives accurate, single-source basis for **cost-cutting** in plant or office: time study, production control, preventive maintenance, locating bottlenecks. Write for free Brochure NR-2.

standard INSTRUMENT CORPORATION
657 BROADWAY, NEW YORK 12, N. Y.

For more facts Circle 525 on Reader Service Card

This is for YOU!

Shows you why Clarage's airfoil fan tops all others where it counts...on-the-job

Stable high efficiency where it counts — under actual operating conditions.

That's what you *get* (not just expect to get) with the Clarage Type AF Dynafoil Fan...perfected for mechanical draft and heavy-duty applications such as industrial processes, conduit type air conditioning, tunnel ventilation.

Contact our nearest sales engineering office or request catalog on coupon at right.

Clarage Fan Company
Kalamazoo, Michigan

Please send me Catalog 859 describing Clarage Dynafoil Fans.

Name_____

Firm_____

Address_____

City_____ State_____

Powell Flow-Matic system in action on packaging line at Goerlich's, Inc., Toledo, Ohio.

Handling 50 million parts a year with POWELL'S *Exclusive Flow-Matic* System!*

Goerlich's Inc., working with Toledo Society of the Blind, stores, assembles, and packages 50 million muffler parts a year—using Powell's unique Flow-Matic materials handling system. Fast, simplified handling method that can save up to 50% in space handling areas. *Bulletin FM* gives all the details—write for it.

TM*

Unique Powell Flow-Matic boxes in storage area at Goerlich's, Inc. Easily handled and stacked.

THE POWELL PRESSED STEEL COMPANY
50 ERIE STREET • HUBBARD, OHIO
The most complete line of material handling equipment.

SMART
PRODUCTION-INCREASING
IDEA!

Save a Machinist's Time
get more production with PROTECTOSEAL *wash and dip tank stations*

When you can keep skilled machinists where they belong—at their machines, doing productive work—you're saving their time and increasing *your* production. Place a Protectoseal Safety Wash or Dip Tank at or near your machines and enable machine operators to wash or clean parts for further work or for inspection *at the job*, and eliminate the unnecessary trips to a centrally located cleaning station.

Protectoseal Wash and Dip Tanks are designed for safe handling of flammable cleaning solutions. A renewable fusible link automatically drops the cover to snuff out fire. All Protectoseal Tanks are Factory Mutual approved, and are available in many types and sizes.

PROTECTOSEAL WASH AND DIP TANK STATION
Complete, self-contained stations, available in various sizes and combinations to meet individual requirements include: Work High Stands, Wash and Dip Tanks in various capacities, Self-Draining Parts Baskets, and 5 Gallon Safety Storage Containers for replenishing tank solvent supply.

OTHER TIME-SAVING PROTECTOSEAL PRODUCTS

MACHINE BENCH CAN
For attachment to machine or bench. Depressing dasher (fire screen) immerses parts in solvent. Spring action returns dasher to original position, allowing parts to drain. 10"x7"x8" deep; cap. 2 gallons.

BENCH PLUNGER CAN
Fire-protective dasher depressed by hand, delivers measured amount of cleaning solvent to rag, swab, brush. Reduces evaporation losses, minimizes hazard of explosive and toxic vapors. 5 sizes.

AIR-MATIC PARTS WASHER
Air operated small parts washer. Parts in basket are moved through cleaning solvent. Requires no operator attention during washing. 15"x15" square, 25½" high. Capacity, 6 gal., 30 lb. basket load.

Write for Protectoseal Catalog of fire-safe products for handling, dispensing, and use of flammable solvents in production operations.

THE PROTECTOSEAL COMPANY
1967 S. Western Ave.-Chicago 8, Illinois

For more facts Circle 527 on Reader Service Card
Circle 528 on Reader Service Card

How three companies use . . .

G-E Power Grooves for Sales Lighting. If you have products to display and sell, G-E Power Groove Lamps can play a vital role, as in the Fontius Shoe Stores, Denver, where 300 footcandles make shoe selection easy—and *fast!*

G-E Power Grooves for High Lighting Levels. Assembly Products, Inc., Chesterland, Ohio, gets 250 footcandles with mighty G-E Power Grooves—eliminated supplementary lighting, and saved *50¢ a square foot initial cost* at the same time!

General Electric Power Groove Lamps

. . . and get the lighting results they want

Conclusion:

You get more and more light for your money . . . year after year . . . with G-E Lamps

Ask your General Electric Lamp distributor which G-E Lamps are *best* for your particular job. General Electric Co., Large Lamp Dept. C-01, Nela Park, Cleveland 12, O.

G-E Power Grooves for Low Initial Cost. In Murray Hill, New Jersey, Bell Laboratories specified 100 footcandles in this engineering office and got it most economically with General Electric Power Groove Lamps.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Coming out or going in . . . A-W crane easily maneuvers Cal-Rex 7-yd. concrete mixer through low clearance doorway.

A-W crane saves valuable space!

"The Austin-Western hydraulic crane saves us valuable space in our plant and storage area. Its small size and high maneuverability permit us to keep aisle width down to 16 ft. The result is a more efficient use of plant facilities.

"We find the A-W so versatile we use it for loading, unloading, handling and storing materials . . . and even moving railroad cars. Its telescoping boom is an outstanding feature; lets us reach into areas inaccessible to other equipment. We've had the A-W about 5 years. It has been very dependable; no maintenance problems."—*R. H. Knaup, Factory Manager, Chain Belt Company, Los Angeles, Calif.*

5 models available

Austin-Western now offers a complete line of lift, carry and place equipment designed to meet every materials handling application; quality-built for years of efficient, trouble-free performance. Available in five models from 3 to 10-ton capacity ranges. Self-propelled, truck or stationary mounting depending upon model. Most models feature full circle, continuous boom rotation; all-wheel drive and all-wheel steer; telescoping boom with manual extensions for extra length—up to 47 ft. on Model 410. For added versatility, such optional equipment as lift fork, load-carrying platform, magnet, clamshell, orange-peel bucket, and remote control maintenance platform is available.

Ask for proof of the ways in which an Austin-Western hydraulic crane can actually save time and money in your materials handling operations! Write us today or see your A-W distributor.

Austin-Western

CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.

BALDWIN · LIMA · HAMILTON

Power graders • Motor sweepers • Road rollers • Hydraulic cranes

For more facts Circle 530 on Reader Service Card

Free 112-page Book

filled with photos and facts about latest industrial data on 123 Minnesota cities, their available sites, and names of local contact. A gold-mine of site-finding facts! For your copy of "Minnesota Welcomes New Industry," write on your firm's letterhead:

Dept. of Business Development, State Capitol, Dept. 448, St. Paul 1,

Minnesota

Circle 531 on Reader Service Card

You Get Things Done With Boardmaster Visual Control

- ☆ Gives Graphic Picture of Your Operations—Spotlighted by Color
- ☆ Facts at a glance — Saves Time, Saves Money, Prevents Errors
- ☆ Simple to operate — Type or Write on Cards, Snap in Grooves
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Complete price $49.50 including cards

FREE 24-PAGE BOOKLET NO. X-500 Without Obligation

Write for Your Copy Today

GRAPHIC SYSTEMS

Yanceyville, North Carolina

Circle 532 on Reader Service Card

In Machining Tenite . . .

Production TRIPLED

MIGGINS SCREW PRODUCTS, INC., BREWSTER, N.Y.

After Installation of a heat-x Coolant Cooler

The problem here was how to maintain *close* temperature control of the coolant. In machining Tenite, too low a temperature causes brittleness; too high a temperature permits softening, with resultant loss of precision and eventual fouling of tools. In addition, the close tolerances required (±.002 on the O.D.) demanded a high degree of machining stability.

The problem was solved by installing a Heat-X cast aluminum cooler with separate condensing unit. Complete packaged units are also available in a wide range of capacities. The coolant (water with a rust inhibiting agent added) is maintained at a constant temperature of 58°F. This accurate temperature control has permitted upping the production rate from 350 to 1100 pieces daily—*more than triple.*

In other operations (machining brass and aluminum, for example) tool life has been doubled as a result of close temperature control of the coolant—which in these cases is conventional cooling oil. Heavier feeds are also possible, hence a marked increase in production.

Whatever *your* cooling or heat transfer problem, check with your nearest Dunham-Bush sales engineer or write the factory direct.

Rugged Heat-X cooler has separate refrigerant and coolant circuits cast within a solid aluminum block.

Request Forms No. 1045, 8060 and 8061 containing complete information on Heat-X cast aluminum liquid coolers and cooler packages.

HEAT-X, Inc.

A Subsidiary of Dunham-Bush, Inc.

BREWSTER • NEW YORK

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

Binks Airless spraying outfits are available for pumping paints direct from 55- or 10-gallon shipping containers to spray guns.

Facts

you should know about

Airless spraying

Q: *Is airless atomization spraying the answer to all spray painting and coating problems?*

A: No! Not by a long shot.

Q: *Where, then, is airless spraying best used?*

A: It is excellent for indoor and outdoor painting maintenance or production work because there is virtually no overspray

Q: *Does Binks manufacture airless spraying equipment?*

A: Yes. These rugged, dependable and mobile outfits incorporate the latest developments.

Q: *Why see Binks first when thinking of airless equipment?*

A: Binks offers you a complete line of spraying equipment. Only Binks offers you the opportunity to objectively compare airless with other techniques to select the equipment best suited to *your* requirements. Binks engineering assistance on finishing problems is likewise completely objective.

Q: *How can more facts be obtained on Binks airless units?*

A: Ask your Binks industrial distributor for Binks Bulletin A98-7. Or, call your nearest Binks Branch Office or write direct.

9629

Binks

EVERYTHING FOR SPRAY PAINTING

SPRAY GUNS

AUTOMATIC EQUIPMENT

ELECTROSTATIC EQUIPMENT

Binks Manufacturing Company
3114-34 West Carroll Avenue, Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

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PALMETTO. PACKINGS

Perfect Combination

PREMIUM QUALITY

COMPETITIVE PRICE

Now—it costs you no more for Palmetto Packings than others of lesser quality. Get the perfect combination of price and quality from your authorized Palmetto distributor. For the name of the supplier nearest you refer to our insert in Thomas' Register—"Packing Section".

Write us for descriptive literature.

GREENE, TWEED & CO.
NORTH WALES, PA.

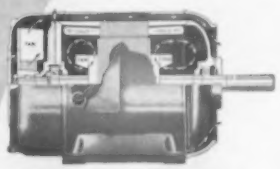
Circle 535 on Reader Service Card

FOR PROVEN ECONOMICAL

POWER

AIR COOLED

Custom Built . . .
NOT Custom Priced



VALLEY
BALL BEARING MOTOR

Here's real power, custom built to fit your every requirement. Totally enclosed — fan cooled — polyphase 50 or 60 cycles — constant speed — squirrel cage induction — high torque — low starting current — enclosed ball bearing.

Send for complete details Today.

VALLEY
ELECTRIC CORPORATION
4221 FOREST PARK BLVD. • ST. LOUIS 8, MO.

Circle 536 on Reader Service Card

Dollar-saving reasons for RENTING

You save working capital! Without large outlays of capital you take immediate possession of all new materials handling equipment. Your present equipment is purchased at full cash value . . . your only actual capital expenditure is one budgeted monthly payment.

Downtime is eliminated! The Clark Rental System maintains a standby fleet of equipment for your immediate use when an emergency arises.

No more maintenance! You rent with full maintenance service included. You no longer need to maintain a special repair shop or parts inventory.

You rid yourself of hidden costs! Wasted clerical and management time . . . inflation . . . the high cost of using obsolete equipment . . . are all eliminated. One budgeted cost is your only cost.

A tailored system! A rental contract is prepared only after a thorough study of your specific operation is made. The flexibility of the Clark Rental System provides you with a *basic* program—without frills or extras—which keeps your handling costs to a minimum

Compare the advantages for yourself! A booklet describing the rental program in detail, including a cost comparison chart, is available without obligation. For your personal copy, write or wire to the address below.

CLARK RENTAL CORPORATION
485 Lexington Avenue
New York 16, N. Y.

CLARK
RENTAL SYSTEM

For more facts Circle 537 on Reader Service Card

ENGINEERING DETAILS MAKE THE DIFFERENCE

At Connors, experienced trackwork engineers design and guide the fabrication of your replacement or new track layouts to assure prompt and precise completion of your order. Every detail is pre-checked to make possible rapid installation at your track site. Contact Connors for:

- light rails
- frogs
- switches
- guard rails
- gauge rods
- crossings
- switch stands
- steel ties
- turnouts.

CONNORS STEEL DIVISION

PORTER

H.K. PORTER COMPANY, INC.

For further information or catalog, write:

West Virginia Works, P. O. Box 118, Huntington, West Virginia

DON'T LET THE PRICE FOOL YOU!

Despite Their Lower Cost

BROOK A.C. MOTORS

Give Outstanding Service

Anybody who knows motors will recognize that there is no finer motor than the Brook. These motors have established excellent service records in industry. Yet, they actually **cost less!**

Space age production methods and extensive distribution in 76 countries makes possible this better motor at lower cost. All standard enclosures. 1 to 600 H.P. Start saving now —look into Brook Motors at once. Write for literature and name of your dealer.

SINCE 1904

BROOK ELECTRIC MOTORS

world's most respected motor

BROOK MOTOR CORPORATION

3302-04 W. Peterson Ave., Chicago 45, Ill.

Factory Representatives, Warehouses, Dealers, Service Stations, in Major Cities

In Canada: Brook Electric Motors of Canada Ltd., 250 University Ave., Toronto, Ont.

For more facts Circle 539 on Reader Service Card

GUARANTEED

to give drip-tight leak-proof seal

greates[illegible] in unions

DART

For over 55 years the firm guarantee back of each and every DART UNION sold has been — *"if one should leak through we will give you two"!* The record reveals that less than 1 in every 100,000 has proven to be faulty. The extra wide bronze to bronze seats, precision ground to a true ball joint, mounted in heavy malleable iron pipe ends and protected by an extra heavy union nut, make a drip-tight, leak-proof connection WITHOUT EXCESSIVE WRENCHING time and time again.

Guarantee positive tight connections and extra long service on your pipe lines by using the DART GUARANTEED UNION.

Yours on request: Descriptive brochure on Dart Unions and Union Fittings.

DART UNIONS
Products of
DART UNION COMPANY
PROVIDENCE, R. I.

GENERAL SALES AGENT

THE **Fairbanks** COMPANY
393 LAFAYETTE STREET, NEW YORK 3, NEW YORK
BRANCHES: NEW YORK 3
PITTSBURGH 22 • BOSTON 10 • ROME, GEORGIA

Circle 538 on Reader Service Card

For more facts Circle 540 on Reader Service Card

EC-1357 cuts costs, makes possible stronger sandwich panels

LABORATORY TESTS show EC-1357 provides the high strength and rigidity called for in nonload-bearing sandwich structures.

3M Adhesive EC-1357 bonds all kinds of skin and core materials *without heat*. You'll speed production, cut costs, build in high strength for non-load-bearing sandwich panels.

You can force-dry the solvent out of the adhesive prior to bonding. And a nip roller or cold press is all that is required to complete the bond.

EC-1357 provides maximum immediate strength. And the bond continues to strengthen as it cures at room temperatures.

Dark in color, EC-1357 absorbs infrared heat quickly, dries fast; so no production delay is necessary. And it sprays on with minimum cobwebbing, thus saving materials.

SEE WHAT 3M ADHESIVES CAN DO FOR YOU!

Consult 3M Research. Contact your 3M Field Engineer. Or, for information and free literature, write: A.C.&S. Division, 3M, Dept. SBFF-20, St. Paul 6, Minnesota.

ADHESIVES, COATINGS AND SEALERS DIVISION

MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

Sprawling plant layout like the PFE repair yards?

Send a CUSHMAN TRUCKSTER®

Pacific Fruit Express, which services its more than 30,000 refrigerator cars in six repair yards across the nation gains greater efficiency and cuts costs by moving men and materials around the yards with a fleet of Cushman Trucksters, both gasoline and electric powered.

THE 780 (Gasoline) **TRUCKSTER**

Rugged, highly maneuverable . . . carries an 800 pound payload for less than a penny per mile. Automotive type shaft drive powered by Cushman Husky 4-cycle engine. Fiber glass and steel cab with wrap-around windshield available as optional equipment.

THE ELECTRIC TRUCKSTER

Equally rugged and maneuverable, operates silently and without fumes . . . carries half-ton payload, travels up to 50 miles on a charge for minimum operating cost. Can be equipped to carry both personnel and cargo. Fiber glass cab available as optional equipment.

Ask your dealer for a demonstration or write for information

CUSHMAN MOTORS
974 No. 21st, Lincoln, Nebraska

A subsidiary of Outboard Marine Corporation, maker of Johnson and Evinrude outboard motors

Please send information on ☐ 780 Truckster, ☐ Electric Truckster

NAME_____

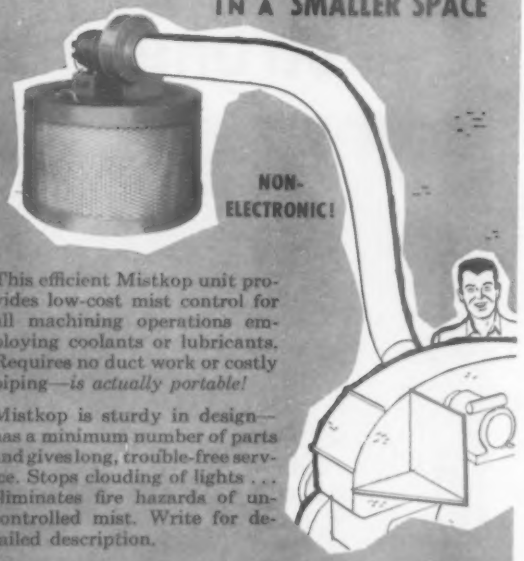
(ATTACH TO YOUR LETTERHEAD)

248 **For more facts Circle 542 on Reader Service Card**

MISTKOP

STOPS MIST

COLLECTS MIST-FOG EFFECTIVELY IN A SMALLER SPACE



This efficient Mistkop unit provides low-cost mist control for all machining operations employing coolants or lubricants. Requires no duct work or costly piping—*is actually portable!*

Mistkop is sturdy in design—has a minimum number of parts and gives long, trouble-free service. Stops clouding of lights . . . eliminates fire hazards of uncontrolled mist. Write for detailed description.

AGET Manufacturing Company
1410 Church Street • Adrian, Michigan

For more facts Circle 543 on Reader Service Card

Seiberling

INDUSTRIAL GLOVES

Longer wear in every pair! Available in various sizes, gauges, lengths, colors and surface finishes. Natural rubber or genuine Dupont neoprene latex. Contoured fingers for more comfort, better fit.

EXCLUSIVE PATENTED
FIRMGRIP®
SAFETY GRIP MOULDED INTO FINGERS AND PALM

SEND FOR CATALOG NO. G-3 of complete glove line

FREE TEST OFFER!
Write us on your firm's letterhead for sample gloves for test purposes.

SEIBERLING LATEX PRODUCTS
New Bremen, Ohio

For more facts Circle 544 on Reader Service Card

LABOR COST CUT 25% ON OVERHEAD CONDUIT AND FIXTURE WORK

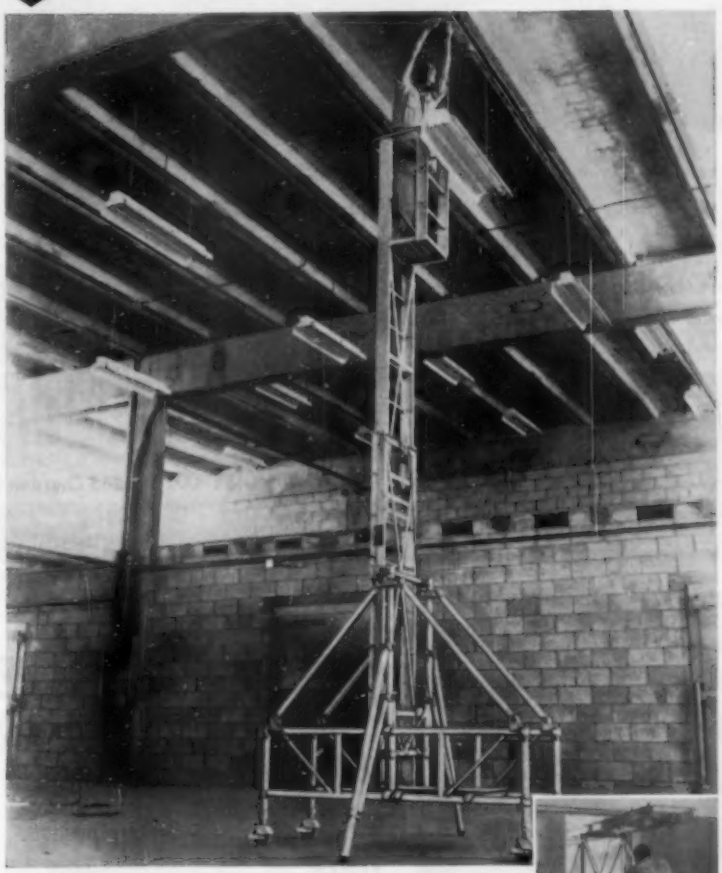
Up-Right aluminum scaffold-on-wheels gets men up in the air fast...lets them finish the job fast! Lightweight and quickly assembled without tools or loose parts, Up-Right scaffolds are adjustable to provide a safe, convenient working platform at any desired height. In 3 basic types for overhead installation and maintenance.

STAIRWAY TYPE

SPAN TYPE

TALLESCOPE

HERE'S HOW INDUSTRY SAVES ON OVERHEAD MAINTENANCE WITH NEW ALUMINUM SCAFFOLD



3,600 fluorescent fixtures in 78 separate bays of Atlanta, Georgia, plant required lamping. Passage from bay to bay was through standard height doorways. Conventional fixed scaffolding requiring dismantling on each move was impractical. Tallescope, the telescoping work platform, was used because it saved 25% of combined set-up and installation time compared with extension ladders and was far safer. Folded down to pass through doorways, it was rolled from bay to bay. Over 3 times the cost of the Tallescope was saved on this single job. Lightweight, rapidly assembled by one man, Tallescope is 29" wide and extends instantly for reaching heights up to 31 feet.

Write for descriptive circulars

UP-RIGHT SCAFFOLDS

DEPT. 178, 1013 PARDEE, BERKELEY, CALIFORNIA

In Canada: Up-Right Scaffolds, Ltd., 120 Russet Ave., Oshawa, Ontario

For more facts Circle 545 on Reader Service Card

Functional Design + Quality Materials + Precision Control
Facilities + Service Accessibility = TOP CRANE VALUE

THE FAMED EUCLID FORMULA PROVIDES YEARS OF LASTING CRANE SERVICE

Name any specific industry! We'll tell you what cranes of ours and where they are at work bolstering the fine EUCLID REPUTATION.

FOUNDRIES, STEEL MILLS, STEEL FABRICATORS, SHIPBUILDERS, GENERAL MANUFACTURERS, PAPER MILLS, WAREHOUSES all know the multifold merits of EUCLID-made cranes.

This 10 ton, cab operated crane with top running trolley and catwalk for servicing, works daily in an assembly bay in the world's largest veneer machinery manufacturer's plant.

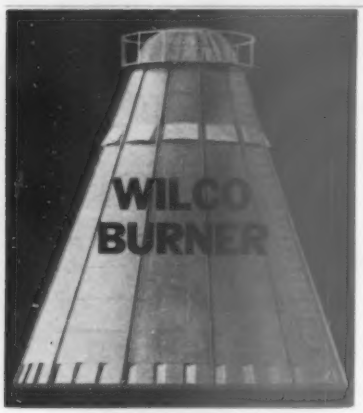
EUCLID

THE EUCLID CRANE & HOIST CO. • 1365 Chardon Road • Cleveland 17, Ohio

WRITE FOR THE CRANE CATALOG

REQUEST A SURVEY of your present facilities by a QUALIFIED EUCLID REPRESENTATIVE

For more facts Circle 546 on Reader Service Card



Slashes Cost of Industrial Trash Disposal

★ Lowest-cost per ton incineration

★ Pre-Fabricated—Sizes, Models for every plant—400 in use

★ Exclusive triple draft assures clean, fast burning

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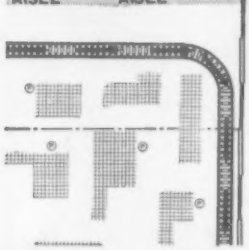

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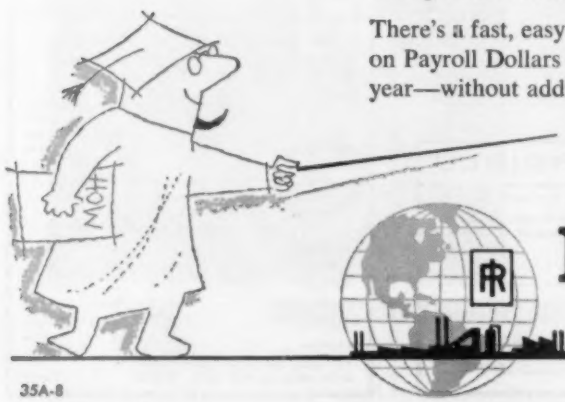

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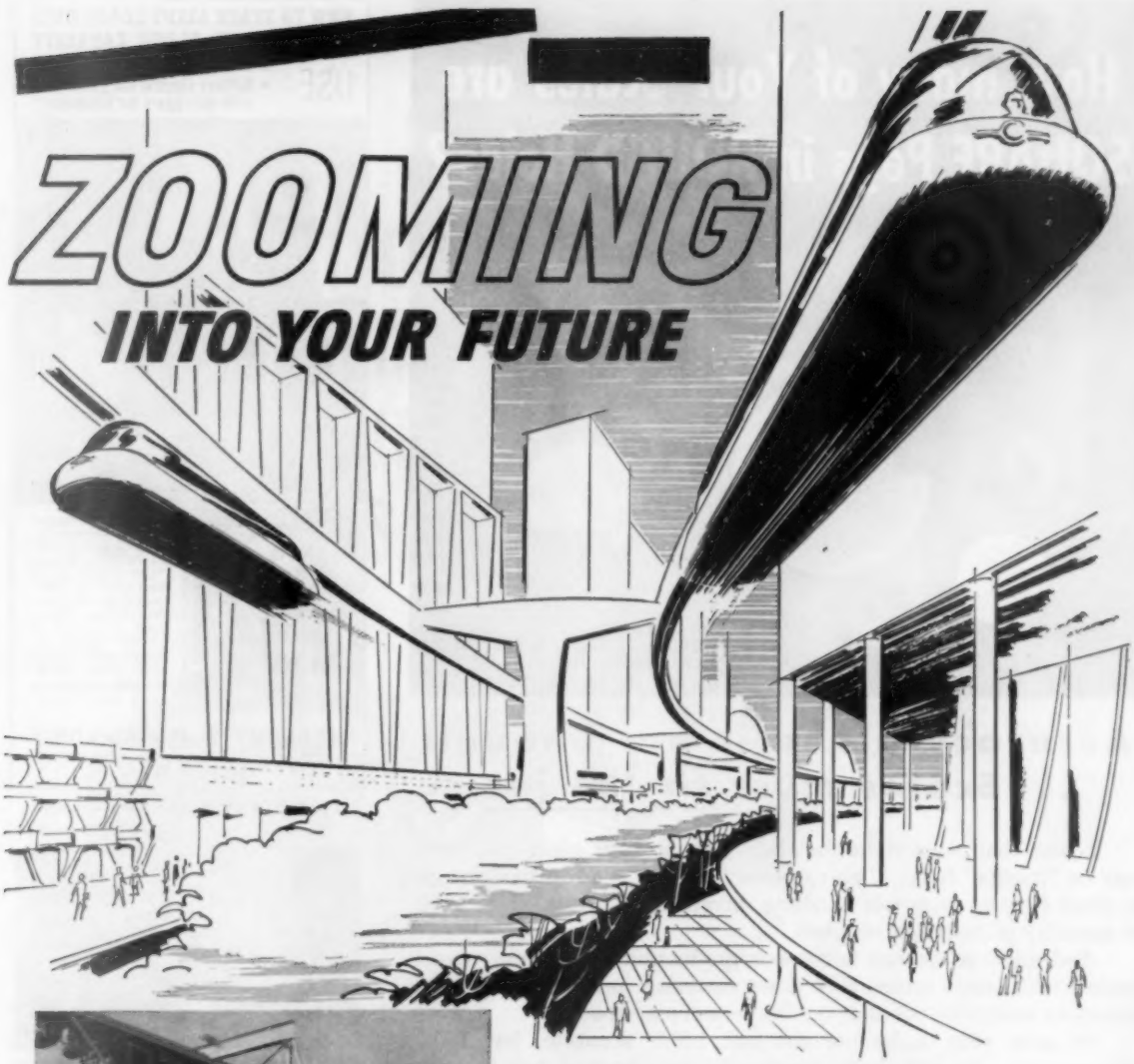

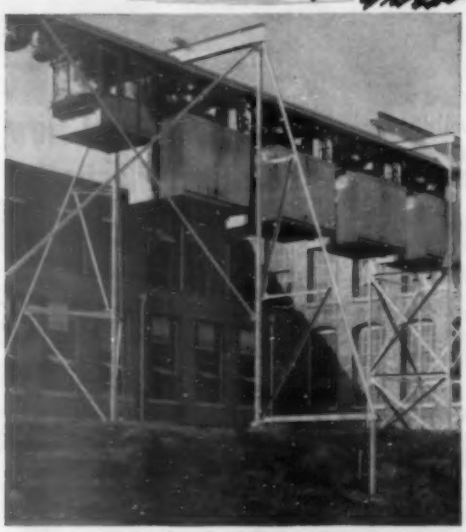

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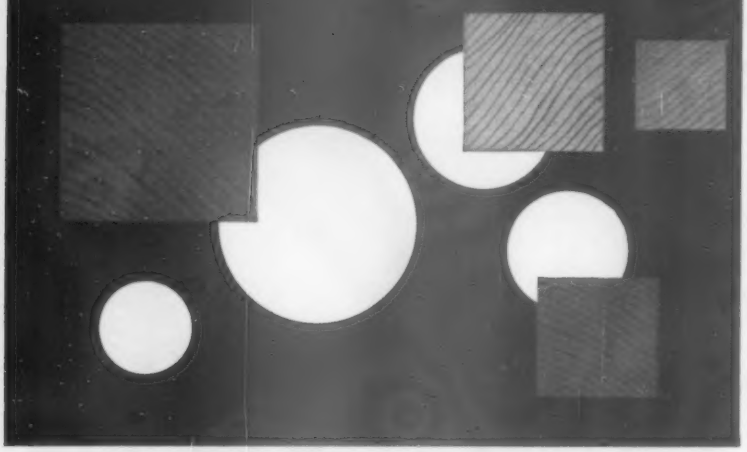

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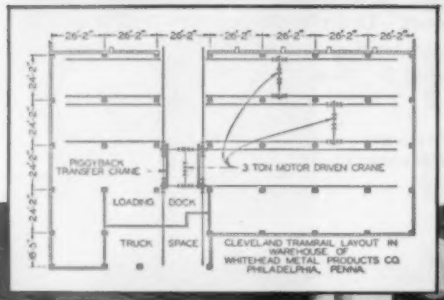
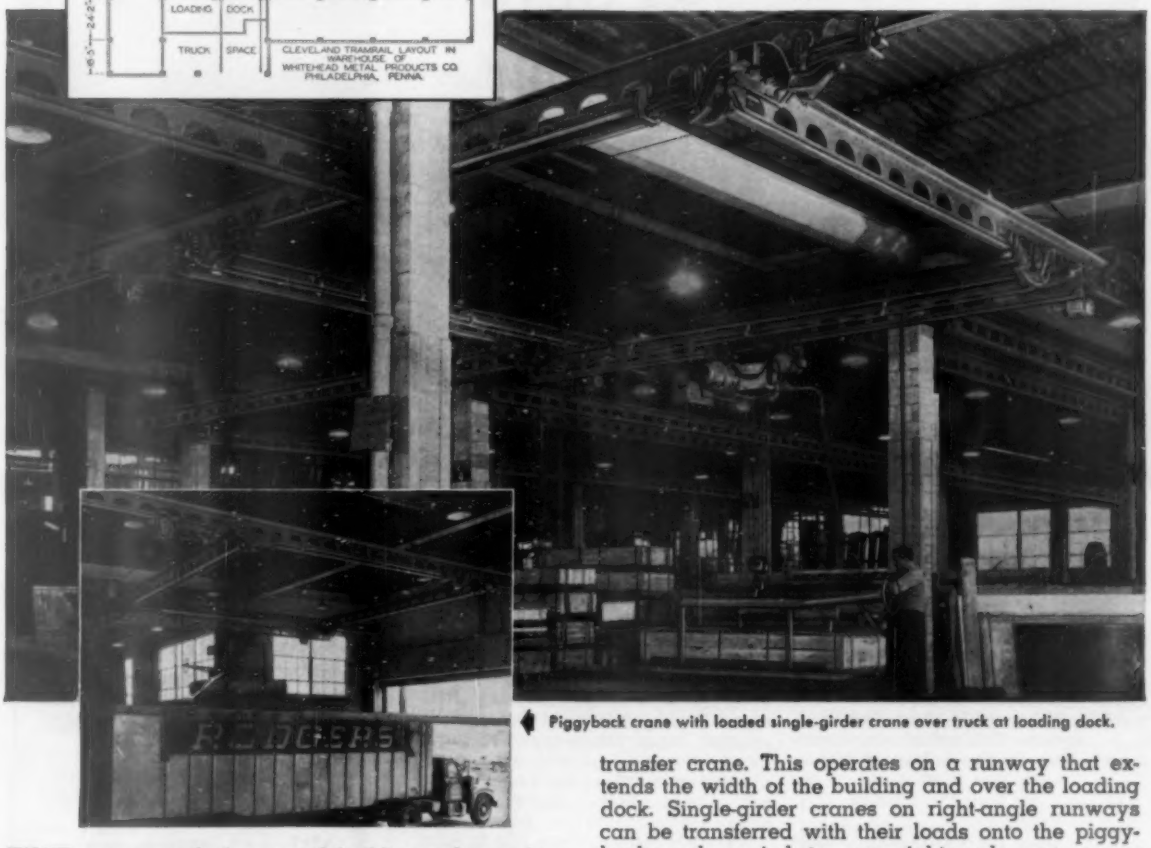
PIGGYBACK CRANE Solves Warehouse Handling Problem


PIGGYBACK TRANSFER CRANE
3 TON MOTOR DRIVEN CRANE
LOADING DOCK
TRUCK SPACE
CLEVELAND TRAMRAIL LAYOUT IN WAREHOUSE OF WHITEHEAD METAL PRODUCTS CO. PHILADELPHIA, PENNA.

Carries Load-Handling Cranes Between Building Columns

Piggyback crane carrying a single-girder crane, which in turn is transporting a case of aluminum sheets with sheet grab. All cranes are 3 ton capacity and motorized. They are easily operated by one man.



Piggyback crane with loaded single-girder crane over truck at loading dock.

THE many regularly spaced building columns in the warehouse of Whitehead Metals, Inc., Philadelphia, posed a tricky problem for the economical handling of flat cases of sheet metal and rectangular crates of pipe and tube, and the multitude of odd shaped cases carried by this metal distributor.

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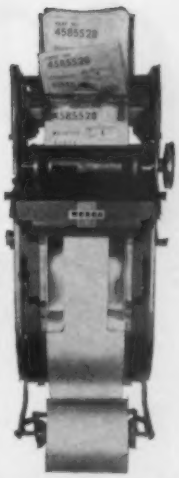

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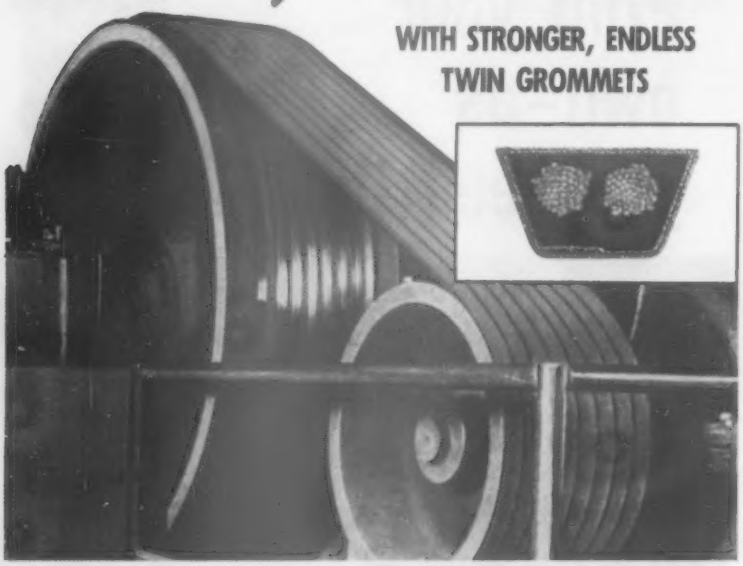

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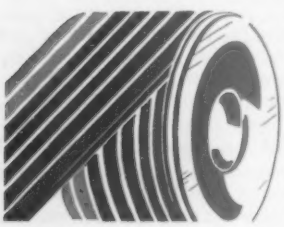

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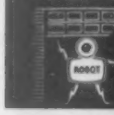

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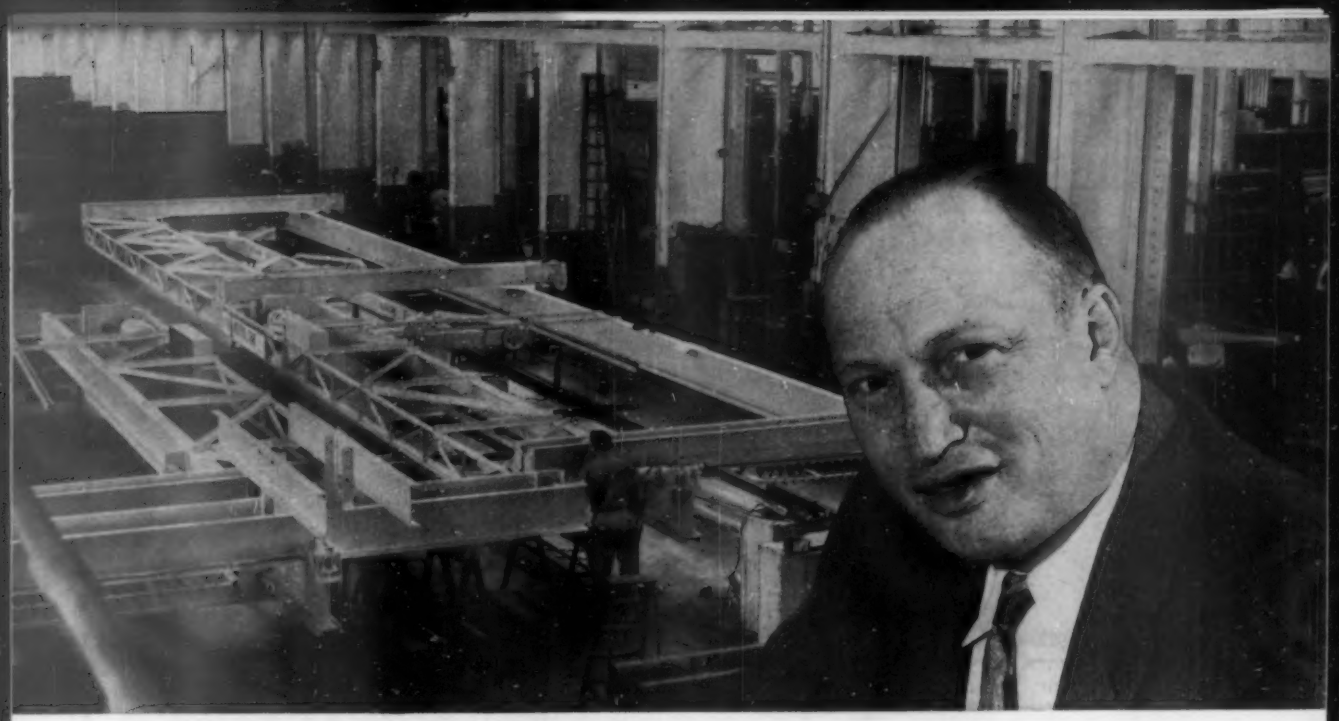

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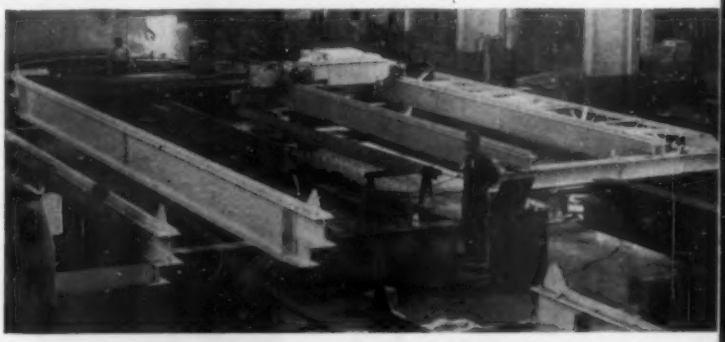

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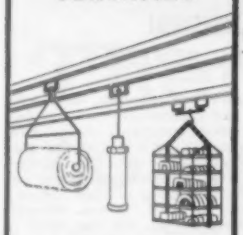

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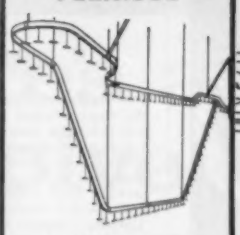

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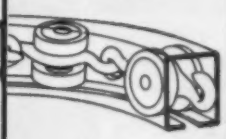

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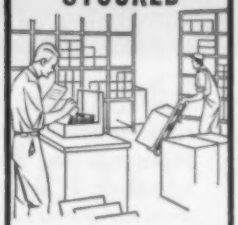

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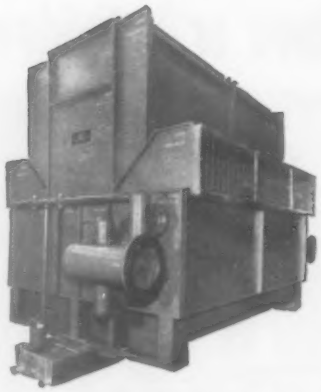

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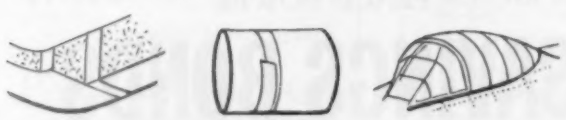

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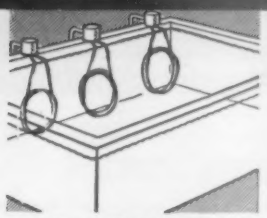
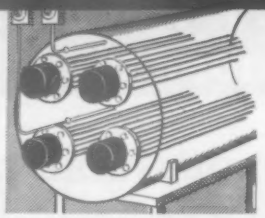
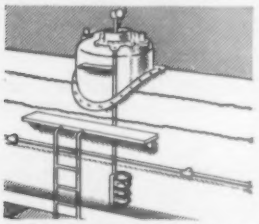


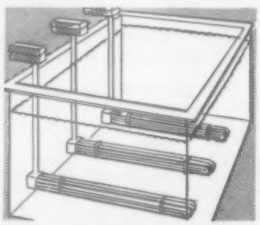
For plating applications, Chromalox CT Immersion Heaters are sheathed in lead, copper, stainless steel.



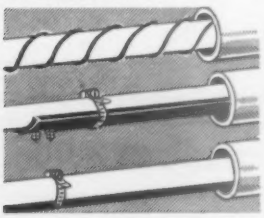
Water heating with TM flange-type Immersion Heaters mounted at one end of a tank.



Heating viscous materials with BLCK Immersion Heaters before pumping from a railroad tank car.



Heating liquid held at constant level. TL Heaters generate heat parallel to the tank bottom.



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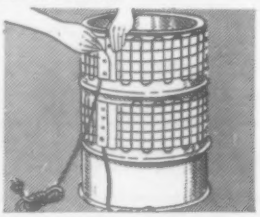

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- And he is a *heating expert* . . . he understands your problem and can help you find the answer.

No matter what your heating problem is . . . solids, liquids or gases . . . call your Chromalox Man for the efficient, *electrical* answer. (*His phone number is listed at the right.*) Or, check the boxes below, write your name, title, and address at the bottom of this page and mail the coupon to us. Edwin L. Wiegand Company, 7500 Thomas Boulevard, Pittsburgh 8, Pa.

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☐ Have a Chromalox Representative contact me.

☐ Send me specific information on the heating problems I have outlined on the sheet attached.

☐ Do not have a Chromalox Representative contact me.

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Electric Heat
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Imagine the odds management is bucking!

No, you can't blame the men. They clocked in at eight this morning – but, as yet, the work hasn't reached their department. Pitching pennies at least passes the time. But you can bet that game of theirs will show up in the company's P and L!

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The list of FACTORY reprints on page 270-H is full of cost-cutting ideas you can use in your plant. Scan the list, pick the titles you want, order them from FACTORY Reader Service, 330 W. 42nd St., New York 36. We'll handle your order promptly. Send cash, or ask us to bill you. (The list on page 270-H does not include all FACTORY reprints. If you want a complete list, just tell us. We'll be glad to send one to you.)

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(See Pages 140, 141, 191)

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(See Pages 52, 53)

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Catalogs in This Issue

To help you, here is a list of catalogs described in this issue. To obtain, circle key numbers on either postcard.

MAINTENANCE

1—Heat Warmers
2—Conveyor Lubricators
3—Hazard Warning Lights
4—Fire Equipment
5—Work Gloves
6—Hydraulic Cylinders
7—Couplings
8—Still-Seal Gaskets
9—Gearbelt Drives
10—Variable Speed Sheave
11—Brakes

VALVES AND FITTINGS

12—Valves, Fittings
13—Butterfly Valve
14—Air Control Valves
15—Flex Joints, Bellows
16—Single Control Valve
17—Butterfly Valves

ELECTRICAL

18—Frequency Meters
19—Circuit Breakers
20—Protective Devices
21—Electric Power Drives
22—Lighting Equipment
23—Multi-Outlet Baseboard
24—Battery Chargers
25—Motor Starters
26—Motor Controls

BUILDING

27—Railings
28—Steel Decks and Doors
29—Thermal Insulation
30—Skylight Products
31—Movable Partitions

MATERIAL HANDLING

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33—Suspension Scale
34—Hoists
35—Coolers and Dryers
36—Trucks
37—Racks, Rack Sections
38—Trucks

AUXILIARY

39—Automatic Firing Equipment
40—Compressors
41—Automatic Boilers
42—Gas-Fired Unit Heaters
43—Heat Exchangers, Steam Jets
44—Air Distribution Equipment
45—Metering Pumps

INSTRUMENTS AND CONTROLS

46—Digital Instrumentation
47—Electronic Instruments
48—Process Timers
49—Predetermining Counters
50—Data Collecting System
51—Recorder/Reproducer
52—Control Systems

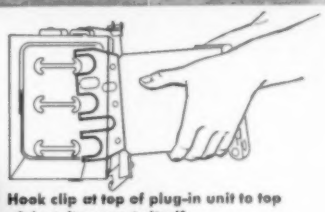
PRODUCTION

53—Bore-Matics, Grinders
54—Verti-Slide Machine
55—Metal Machining
56—Welding Fittings
57—Flame-Cutting Machine
58—Shear Knives
59—Induction Heating
60—Machine Shop Accessories
61—Punching, Notching Units
62—Press Brakes
63—Thread and Form Grinders

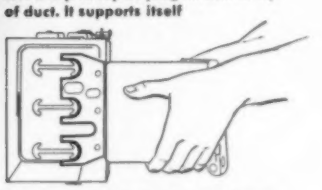
Another Reason for Using Square D Aluminum Plug-in Duct...

SQUARE D PLUG-IN UNITS GIVE YOU EXCLUSIVE *hook-swing* MOUNTING

Safer, Faster, Easier Mounting



Hook clip at top of plug-in unit to top of duct. It supports itself



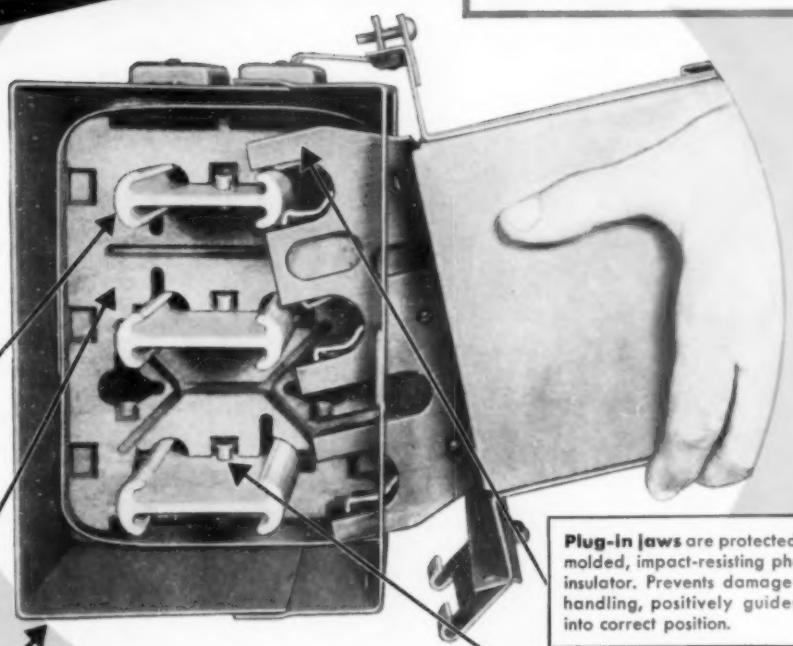
Then, just swing plug-in unit down until jaws engage bus bars

Hanger mounting (*not shown*) makes installation easy. A universal hanger permits mounting in *any* position. Just suspend and level top portion of hanger, then clip on lower portion. U.L. approved for 10-foot spacing.

I-beam construction of bus bars—a Square D exclusive—provides four times the strength of conventional bus bars. Bars are zinc, copper and silver-plated full length.

Full width bus support provides greater strength on short circuits, freedom from vibration. Also acts as fire stop where duct passes through walls and floors.

Square D duct is totally enclosed for maximum safety—no danger of accidental shorts. Prevents overheating from dust accumulation.



Plug-in jaws are protected by a molded, impact-resisting phenolic insulator. Prevents damage from handling, positively guides unit into correct position.

Steel pins in each bus bar prevent bars from shifting and support them on vertical riser installations.

With other plug-in duct, it's no easy job to mount the plug-in units. In fact, it takes a lot of real pushing which is neither safe nor easy when you're working on a ladder. With Square D's exclusive *hook-swing* mounting, you just hook the plug-in unit to the top of the duct. Then, simply swing it down and in until the jaws have engaged the bus bars. No awkward pushing required—no unnecessary chances to take.

Square D aluminum plug-in duct with exclusive *hook-swing* mounting costs no more—why settle for less?

Write for Bulletin SD-110. It gives the facts on Square D aluminum plug-in duct. Address Square D Company, 1601 Mercer Road, Lexington, Kentucky

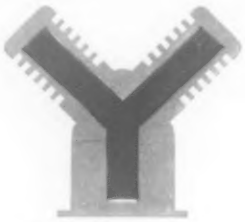
SQUARE D COMPANY

wherever electricity is distributed and controlled

For more facts Circle 571 on Reader Service Card

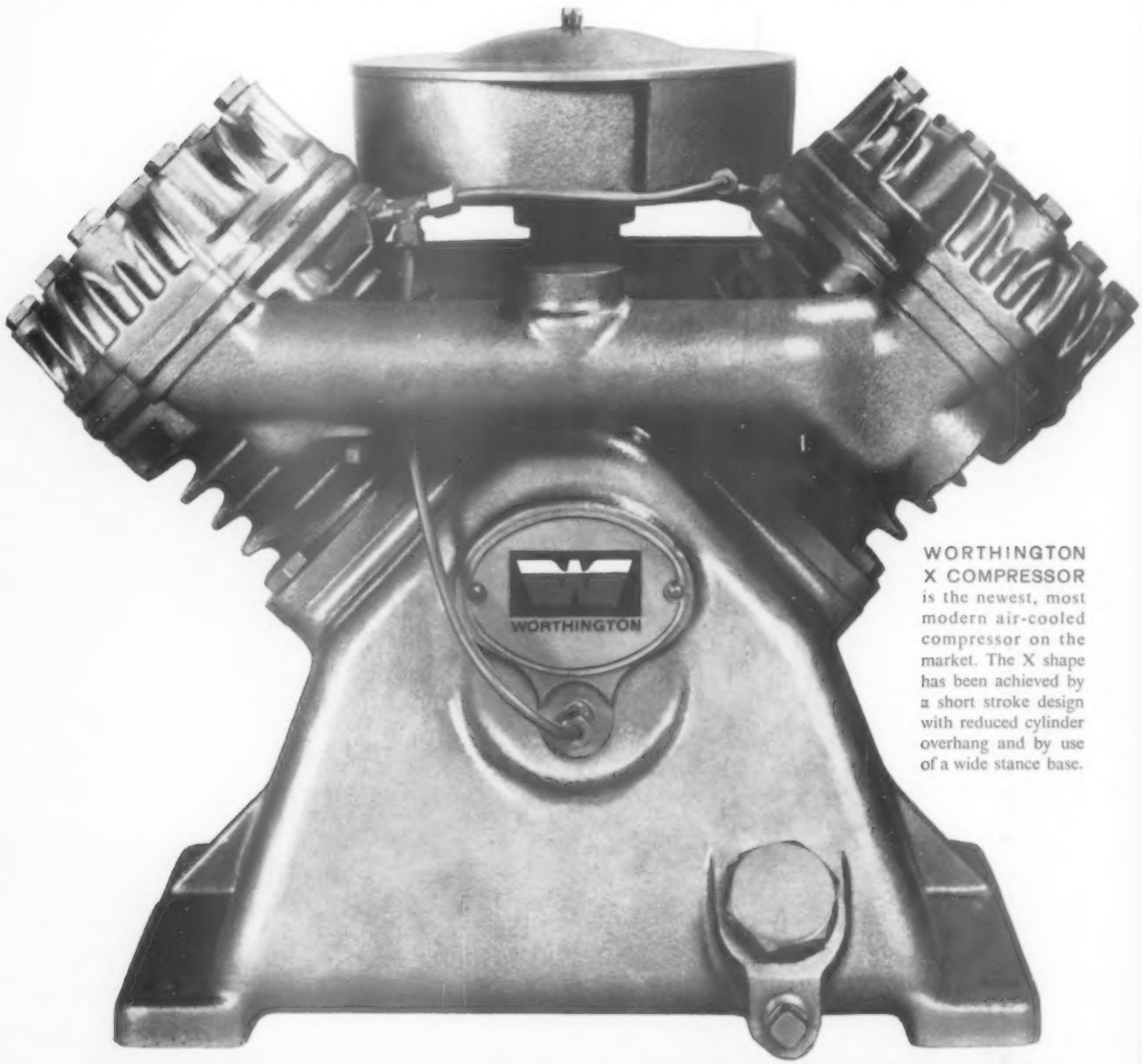
INTRODUCING: THE ALL-NEW

I-SHAPE compressor is prone to harmful vibration in both horizontal and vertical planes as the two pistons travel up and down in opposite directions. Cooling is also a problem. Only one cylinder is in the direct path of cooling air from the compressor fan and there is about 40% less cooling surface.



Y-SHAPE increases cooling by spreading cylinders. The vibration problem, however, is only partially solved. Pistons operating at 45 degrees to horizontal tend to rotate the compressor. When supported by a small, narrow base the unit tends to be unstable and prone to harmful vibration.

X-SHAPE compressor gives excellent cooling plus minimum vibration. The same twisting forces occur as the pistons move back and forth but this compressor with its wide stance base is more stable. As a result, there is less internal strain, and vibration is considerably reduced.



WORTHINGTON X COMPRESSOR is the newest, most modern air-cooled compressor on the market. The X shape has been achieved by a short stroke design with reduced cylinder overhang and by use of a wide stance base.

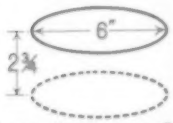
WORTHINGTON X COMPRESSOR

New design reduces vibration—enemy of compressor life

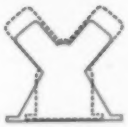
Vibration is the mortal enemy of every reciprocating machine. Sooner or later vibration must exact its toll in the form of wear or failure. Controlling vibration is the secret of building compressors that run longer and quieter with less maintenance.

Our new X compressor was designed to be the most "rock steady" unit on the market. *Vibration is so negligible that we have balanced a coin on an X compressor while it was running.*

The story behind this first air cooled compressor redesign by a major manufacturer in 15 years is interesting.



Our engineers started with a modern short stroke, large bore design. (A typical cylinder has a diameter of 6″; stroke of only 2¾″.) This design reduces piston travel and wear, and increases efficiency.



The short cylinders that resulted made it possible to reduce cylinder overhang considerably. Then the width of the base was increased until an X shape was obtained.

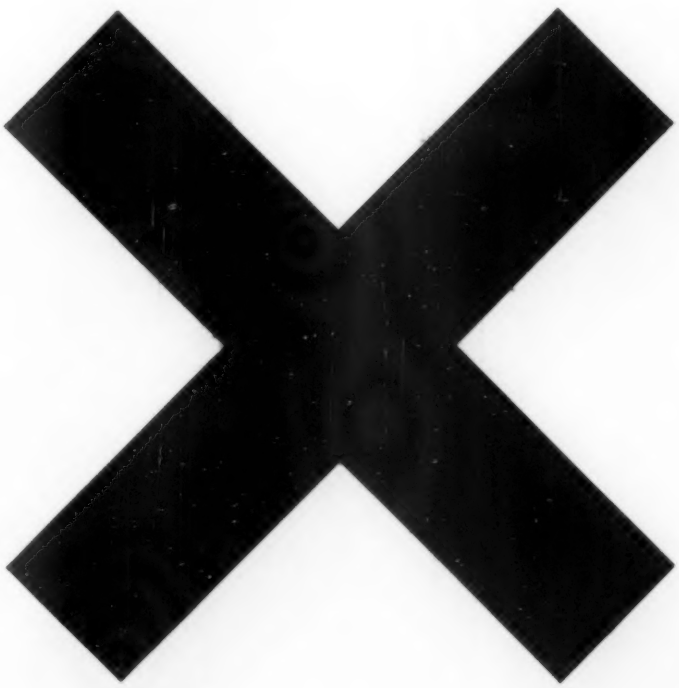
Concurrently, the decision was made to operate at higher rotative speeds. This reduced size and weight. The X design is 15% to 20% smaller and lighter than most compressors. The X compressor was designed to operate up to 1750 rpm (versus a top of 900 or so for most other units.) Its short stroke design, however, makes piston speeds very conservative. They never exceed 700 feet per minute.

The new X compressor has many other innovations. Its silicon treated filter element is 99%+ efficient. Its shell-molded, ductile iron crankshaft has better balance and greater strength. Its aluminum connecting rods increase heat conductivity and reduce reciprocating weight. In all, more than 25 separate innovations were incorporated in the design.

The new X compressor is equipped with Worthington's famous Feather* valve. The lightest, fastest-acting valve in the industry, the Feather valve has compiled an outstanding performance record. (A recent survey indicates that operating men prefer them two to one over the next nearest type).

Worthington's new X compressor is available as a bare compressor or base or tank mounted. Standard belt-driven units are available in ratings from ¾ to 15 hp and 40 to 250 psi. Monobloc units from 1½ to 5 hp, 175 psi. Please mail coupon for more information.

*Reg. Trademark U. S. Pat. Off.



WORTHINGTON CORPORATION
SECTION 34-1
HOLYOKE, MASS.

I'm interested. Send me a copy of Bulletin 3405-B2 describing your new X compressor line.

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COMPANY_____

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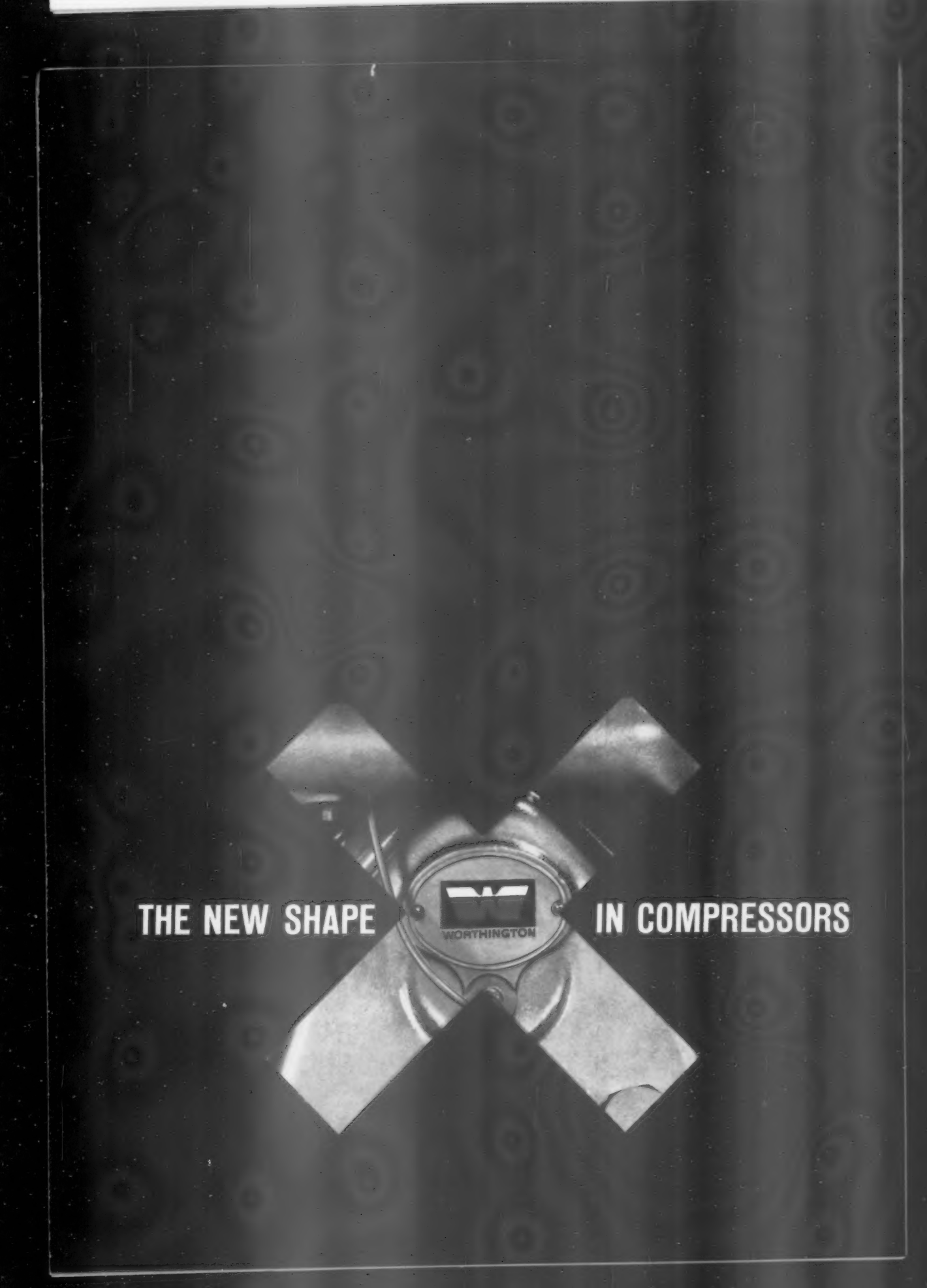
THE NEW SHAPE
WORTHINGTON
IN COMPRESSORS